IN THE HIGH COURT OF THE REPUBLIC OF SINGAPORE

[2017] SGHC 310

Suit No 470 of 2012

Between

ROHM AND HAAS ELECTRONIC MATERIALS CMP HOLDINGS, INC (FORMERLY KNOWN AS RODEL HOLDINGS, INC)

… Plaintiff

And

(1) NEXPLANAR CORPORATION

(2) WAH LEE TECH (SINGAPORE) PTE LTD

… Defendants

JUDGMENT

[Patents and Inventions] — [Validity]
[Patents and Inventions] — [Novelty]
[Patents and Inventions] — [Inventive step]
[Patents and Inventions] — [Infringement]

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v
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8 December 2017 Judgment reserved.

George Wei J:

Introduction

1 This suit involves a patent for a polishing pad used in the field of semiconductor manufacturing. The plaintiff alleges that the defendants infringed its patent by selling and dealing with certain polishing pads manufactured by the first defendant. In their defence, the defendants deny that their actions amount to infringement of the plaintiff's patent, and further contend that the plaintiff's patent is invalid for lack of novelty, lack of inventive step and insufficiency of particulars. The defendants also counterclaim for the revocation of the patent.

2 The trial of this suit was heard over ten days in January 2017, with closing submissions filed in March 2017. I now deliver my judgment.

Background facts

3 The plaintiff, Rohm and Haas Electronic Materials CMP Holdings, Inc (formerly known as Rodel Holdings, Inc) ("the Plaintiff"), is a company incorporated in the United States of America and the subsidiary of Dow Chemical Company ("Dow Chemical"). It was the registered proprietor of Singapore Patent No 43335, in respect of a "Polymeric Polishing Pad Containing Hollow Polymeric Microelements" ("the Patent")[1], which expired on 2 August 2013.[2]

4 While I will go into greater technical detail later in my judgment, at this juncture, I will first provide a simple description of the Patent and a brief explanation of the context in which the claimed invention is used. The claimed invention relates to the field of semiconductor manufacturing. Semiconductors are built on thin round discs or wafers, commonly made of silicon. One of the stages in wafer manufacturing is known as "chemical mechanical polishing / planarisation" ("CMP"), which refers to the process of smoothening a surface by means of a combination of chemical and mechanical forces. In the CMP process, the wafer is pressed against a polishing pad, and both the wafer and the pad rotate while in contact with each other. At the same time, an abrasive and corrosive chemical slurry is dispensed onto the polishing pad to aid in the smoothening of the wafer.[3]

5 The claimed invention is a polishing pad used to polish or planarise the surface of an electronic substrate such as a wafer. This pad includes a polymeric

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1 Statement of Claim (Amendment No 2) ("SOC"), paras 1–2; Defendants' ("Ds'") Closing Submissions, paras 7–8.

2 Ds' Closing Submissions, Annex B.

3 Ds' Closing Submissions, paras 14–16.

matrix or substrate that is embedded with hollow polymeric microelements. The pad comprised a "work surface" with microelements that come into direct contact with the work-piece, as well as another "subsurface" of microelements. The microelements at the work surface are less rigid than those embedded in the subsurface. As the work surface wears out, the subsurface becomes the new work surface. The regeneration of the subsurface as the new work surface allows for a more consistent and even polishing of the wafer.[4]

6 The Patent consists of 21 claims, of which only eight have been put in issue in the present case ("the asserted claims"). What this means is that only eight claims are relied on by the Plaintiff. The table below sets out these eight asserted claims in full, according to the patent specification filed with the Intellectual Property Office of Singapore on 23 February 1996[5] and amended most recently on 23 August 1999:[6]

Claim No	**Description**
1	A polishing pad for polishing or planarizing a surface of an electronic substrate, said pad comprising a polymeric matrix impregnated with a plurality of hollow, flexible, organic polymeric microelements, said pad having a work surface and a subsurface proximate to said work surface, one portion of said polymeric microelements being at said work surface and exposed to a working environment including a polishing slurry, another portion of said polymeric microelements being embedded within said subsurface of said pad that is not exposed to said working environment, said work surface of said pad is relatively softer than said subsurface as a result of said exposure of said one portion of said polymeric microelements at said work surface to said working

4 Plaintiff's ("P's") Closing Submissions, paras 3–5.

5 Ds' Closing Submissions, Annex B.

6 Agreed Bundle of Documents, Vol 1 ("1ABD"), Tab 1.

	environment, and said subsurface becomes said relatively softer work surface during wear of said pad when said polymeric microelements are exposed to said working environment.
2	A pad according to claim 1, wherein said polymeric microelements are substantially uniformly distributed throughout said polymeric matrix.
3	A pad according to claim 1, wherein said polymeric matrix comprises a urethane polymer.
8	A pad according to claim 1, wherein said polymeric microelements have a mean diameter less than about 150 μm.
10	A pad according to claim 1, wherein said polymeric microelements are spaced apart by about 1 μm to about 100 μm.
11	A pad according to claim 1, wherein at least some of said polymeric microelements are generally spherical in shape.
12	A pad according to claim 1, wherein at least some of said polymeric microelements have permeable shells so that said hollow microelements may be rendered open to said working environment.
21	A polishing pad for polishing or planarizing a surface of an electronic substrate, said pad comprising a polymeric matrix impregnated with a plurality of hollow, flexible, organic polymeric microelements, said pad having a texturized work surface and a subsurface proximate to said work surface, one portion of said polymeric microelements being at said work surface and exposed to a working environment including a polishing slurry, another portion of said polymeric microelements being embedded within said subsurface of said pad that is not exposed to said working environment, said texturized work surface of said pad is relatively softer than said subsurface as a result of said exposure of said one portion of said polymeric microelements at said work surface to said working environment, and said subsurface becomes said relatively softer work surface during wear of said pad when said polymeric microelements are exposed to said working environment.

7 Out of the asserted claims, it is undisputed that only claim 1 and claim 21 are independent claims, while claims 2, 3, 8, 10, 11 and 12 relate back to claim 1. Claim 21 differs from claim 1 only in that the "work surface" is described as a "texturized work surface".

8 On 19 September 2000, the Plaintiff obtained a grant of the Patent under s 29(1)(*c*) of the Patents Act (Cap 221, 1995 Rev Ed) by relying on the final search and examination results of its corresponding US patent, US Patent No 5,578,362 ("the US Patent").[7] The asserted claims of the Patent set out in the table at [6] above are identical to those in the US Patent. The wording of the US Patent only differs slightly from that of the Patent for claims 13 and 18 which are not asserted, and these differences are not material or significant.[8] The Plaintiff claimed priority from the date of its application to the US Patent and Trademark Office for the US Patent, 19 August 1992.[9]

9 The first defendant, NexPlanar Corporation ("the 1st Defendant"), is a US-incorporated company in the business of designing and manufacturing CMP pads. The second defendant, Wah Lee Tech (Singapore) Pte Ltd ("the 2nd Defendant"), is a locally-incorporated company which imports and purchases CMP pads from suppliers such as the 1st Defendant and resells the CMP pads to its customers in Singapore. I will refer to the 1st and 2nd Defendants collectively as "the Defendants".[10]

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7 Ds' Closing Submissions, Annexes A and B.

8 2ABD, p 301.

9 Ds' Closing Submissions, Annex B.

10 Ds' Closing Submissions, paras 7–8.

The Plaintiff's case

10 On 5 June 2012, the Plaintiff commenced the present suit against the Defendants. According to the Plaintiff, certain CMP pads manufactured and sold by the 1st Defendant infringed the asserted claims of the Patent. The CMP pads in question ("the NexPlanar Pads") corresponded to twelve of the 1st Defendant's pad models, namely, "NEX4-6035-30S", "NEXX-0901", "NEXX-09NH-30S-25-70TS-4CF", "NEXX-09NP-30S-25-70TS-4CF", "NEXX-09V1", "E7980-30S-25-70TS-4CF", "NEXX-09P6-30S", "NEXX-09P7-30S w/ sub-pad 4", "NEXPLANAR PAD-NEXX-09NF-30S-25", "NEXPLANAR PAD NEXX-09NP-30S-25-70TS-40F", "NEXX-09V1-30S" and "Nexx-09NH".[11]

11 The Plaintiff alleges that the following acts by the Defendants between 2010 and 2012 constitute infringement of the Patent:[12]

(a) the 1st Defendant's sale of (or offer to sell) the NexPlanar Pads to the 2nd Defendant around late 2010 to the first quarter of 2012, for the purpose of the 2nd Defendant's sale, offer to sell, importation, use or keeping of the NexPlanar Pads;

(b) the 2nd Defendant's importation, use or keeping of the NexPlanar Pads around late 2010 to the first quarter of 2012; and

(c) the 2nd Defendant's sale of (or offer to sell) the NexPlanar Pads to a company known as United Microelectronic Corporation ("United Microelectronic") between late 2010 and the first quarter of 2012.

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11 Particulars of Infringement (Amendment No 2) ("POI"), paras 2–2A.

12 POI, paras 2–2A.

The Plaintiff further asserts that the 1st Defendant directed, authorised, procured, assisted or enabled the 2nd Defendant to infringe the Patent, and/or acted in concert with the 2nd Defendant pursuant to a common design to infringe the Patent.[13] No infringement action was brought against United Microelectronics.

12 The Plaintiff thus claims against the Defendants for:

(a) a declaration that the Patent was valid and that it was infringed by the Defendants;

(b) an injunction to restrain the Defendants from making, disposing of, offering to dispose of, using, importing and/or keeping products which infringe the Patent;

(c) an injunction to restrain the 1st Defendant from:

(i) directing, authorising, procuring, assisting or enabling the 2nd Defendant to infringe the Patent; and/or

(ii) acting in concert with the 2nd Defendant in furtherance of the said infringement pursuant to a common design;

(d) an inquiry as to damages or an account of profits made by the Defendants, and an order for payment for all sums found to be due upon making the inquiry or account;

(e) an order for the delivery up and/or destruction of all infringing products which are in the possession, custody or control of the Defendants;

(f) full discovery of all matters relating to this action; and

13 SOC, para 6.

(g) interest, costs and any further relief.

The Defendants' case

13 The Defendants do not dispute that they did in fact deal with the NexPlanar Pads in Singapore between 2010 and 2012.[14] However, they deny infringement on the basis that the NexPlanar Pads do not fall within the asserted claims of the Patent. The Defendants assert that the plain and ordinary language of claim 1 of the Patent informs a skilled reader that the claimed invention is a conditioned or "broken-in" pad which is in use for polishing an electronic substrate, and therefore does not cover new, as-received and unconditioned pads. In contrast, the NexPlanar Pads dealt with by the Defendants were new, as-received and unconditioned pads, and therefore do not fall within the scope of the asserted claims.[15]

14 The Defendants further deny being joint tortfeasors, as they did not engage in any common design to infringe the Patent. The Defendants assert that their relationship is purely that of a buyer and a seller.[16]

15 Further, both as a defence and a counterclaim for revocation of the Patent, the Defendants contend that the Patent has always been invalid for the following reasons:

(a) First, the Patent was not novel as it had been anticipated by the prior use and sale of the Plaintiff's own "IC-1000" pads to Intel

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14 Ds' Closing Submissions, para 11.

15 Ds' Closing Submissions, paras 2–3.

16 Ds' Closing Submissions, para 5.

Corporation ("Intel") before the Patent's priority date of 19 August 1992.[17]

(b) Second, the Patent did not involve an inventive step, as the prior art rendered the invention obvious. On this point, the Defendants rely on various pieces of prior art:[18]

(i) Japanese Publication 02-232173 in respect of a Japanese patent owned by Rodel Nitta Company, a joint venture between the Plaintiff and Nitta Corporation of Japan, published on 14 September 1990 ("the Japanese Patent");

(ii) US Patent No 2,806,772, granted on 17 September 1957 ("the Robie Patent");

(iii) three publications by Akzo Nobel (collectively, "the Akzo Nobel Publications"), namely, Technical Bulletin No 20 dated 25 January 1989 ("the January 1989 Bulletin"), Technical Bulletin No 22 dated 2 October 1991 ("the October 1991 Bulletin") and an article titled "Introduction to Expancel Microspheres" dated April 1991 ("the Akzo Nobel Article");[19]

(iv) a product brochure of the Plaintiff's "IC-1000" pad, published in December 1991 ("the Brochure");

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17 Ds' Closing Submissions, para 1(a).

18 Ds' Closing Submissions, para 12.

19 P's Core Bundle of Documents ("PCBD"), Tabs 5 to 7.

(v) US Patent No 5,081,051, granted on 14 January 1992 ("the Mattingly Patent"); and

(vi) a study entitled "The Mechanical Properties of Cellular Solids" by M F Ashby, published in Volume 14A of *Metallurgical Transactions* in September 1983 at pages 1755 to 1769 ("the Ashby article").

(c) Third, the specification of the Patent did not disclose the invention with sufficient clarity and completeness for it to be performed by a person skilled in the art, *ie*, it failed the requirement of "sufficiency" or "enabling disclosure".

16 Finally, the Defendants contend that even if the Patent is found to have been valid and infringed, no question of injunction (as the Plaintiff claims at [12(b)]–[12(c)] above) can arise as the Patent has already expired.[20]

17 The Defendants thus counterclaim against the Plaintiff for:

(a) a declaration that the Patent has always been invalid;

(b) an order that the Patent be revoked;

(c) a declaration that the Defendants have not infringed the Patent; and

(d) costs and any further relief.

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[20] Ds' Closing Submissions, para 6.

The witnesses

The independent assessor

18 The appointment of an independent assessor for this action arose from Summons No 5772 of 2014, filed by the Defendants to strike out certain paragraphs in the affidavits of evidence-in-chief ("AEICs") of four of the Plaintiff's witnesses and in a report prepared by the Plaintiff's expert witness Prof Jerold M Schultz ("Prof Schultz"). These paragraphs related to various tests carried out by the Plaintiff's employees and Prof Schultz on certain CMP pads manufactured by the Defendants. The Defendants argued that the Plaintiff had not filed the requisite notice under O 87A r 6 of the Rules of Court (Cap 322, R 5, 2014 Rev Ed) ("ROC") proposing the conduct of any experiments.

19 On 2 February 2015, Tay Yong Kwang J (as he then was), who previously had conduct of the pre-trial stages of this suit, ordered that Dr Leong Yew Wei ("Dr Leong") be appointed as the independent assessor for this action. The appointment of an independent expert is allowed under O 40 r 1 of the ROC. The role of such an expert is to aid in the court's decision-making and understanding of technical issues (see *Mühlbauer AG v Manufacturing Integration Technology Ltd* [2010] 2 SLR 724 ("*Mühlbauer*") at [45]), although the decision is ultimately for the court to make (*Singapore Civil Procedure 2017*, Vol 1 (Foo Chee Hock gen ed) (Sweet & Maxwell, 2017), para 40/1/3). In particular, Dr Leong's role here was to:

(a) witness and assess the tests outlined in Dr Schultz's expert report and the AEICs of the Plaintiff's witnesses;

(b) document all observations and data related to such tests;

(c) fill in an assessment chart provided by the Plaintiff and state whether he agreed or disagreed with the facts that the Plaintiff sought to prove, after witnessing the tests; and

(d) provide the court with a report summarising his observations and assessment ("the Independent Assessor's Report").

20 These tests were conducted from 1 to 5 June 2015 in Delaware, USA, where the Plaintiff has its principal place of business, and in the presence of Dr Leong and the parties' representatives.[21] As these tests were mainly concerned with infringement rather than the validity of the Patents, I will address Dr Leong's findings in the Independent Assessor's Report later in my judgment.

Other witnesses

21 Over the course of the trial, the Plaintiff called five factual witnesses and two expert witnesses, namely:

(a) Mr Harry McClain ("Mr McClain"), an engineering planner of the Plaintiff, and one of the co-inventors of the invention claimed in the Patent;[22]

(b) Mr John Roberts ("Mr Roberts"), a retired scientist formerly employed by the Plaintiff, and another co-inventor of the claimed invention;[23]

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21 Ds' Core Bundle of Documents, Vol 1 ("1DCBD"), Tab 2.

22 Agreed Bundle of Affidavits, Vol 1 ("1ABA"), p 506.

23 2ABA, p 977.

(c) Ms Joan Koppenbrink ("Ms Koppenbrink"), who was employed by the Plaintiff in various roles, including director of marketing, from 1986 to 1996;[24]

(d) Mr Lee Cook, a technology fellow and director of slurry research of the Plaintiff;[25]

(e) Mr Blake Biederman ("Mr Biederman"), a legal counsel of the Plaintiff;[26]

(f) Prof Ronald Gutmann ("Prof Gutmann"), an independent consultant specialising in fields including semiconductor manufacturing technology and semiconductor devices;[27] and

(g) Prof Schultz, an emeritus professor at the University of Delaware, engaged by the Plaintiff to investigate and render his professional opinion on whether three models of the NexPlanar Pads manufactured by the 1st Defendant infringed the asserted claims of the Patent.[28] Prof Schultz's opinion was based on the results of certain experiments (see [18] above), which were jointly designed by him and the Plaintiff's employees, and conducted by the Plaintiff's employees.[29]

22 The Defendants called three factual witnesses and one expert witness, namely:

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24 1ABA, p 499.

25 2ABA, p 909.

26 1ABA, p 558.

27 3ABA, p 1478.

28 2ABA, p 1145.

29 Notes of Evidence ("NE") Day 3, p 26.

(a) Mr Jim LaCasse ("Mr LaCasse"), the President and Chief Executive Officer of the 1st Defendant;[30]

(b) Mr Chang Chih-An ("Mr Chang"), the Deputy Managing Director of the 2nd Defendant;[31]

(c) Prof Ken Cadien ("Mr Cadien"), an engineer and university professor, who was formerly employed by Intel from 1990 to 2006 in a senior position to do work dealing with CMP technology and processes, and was asked to join the 1st Defendant's technical advisory board in 2007;[32] and

(d) Dr Mansour Moinpour ("Dr Moinpour"), an independent consultant specialising in fields including semiconductor process technology and CMP.[33] Dr Moinpour was brought in by the Defendants to replace the Defendants' original expert witness, Prof David Dornfeld ("Prof Dornfeld"), who had passed away prior to the trial.[34] I note that the late Prof Dornfeld had filed affidavits in this action prior to his passing.

23 Both sides led evidence from the aforementioned witnesses on issues pertaining to infringement and validity of the Patent. Where relevant, I will refer to the factual evidence and expert reports given by the witnesses in the course of my decision.

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30 3ABA, p 1677.

31 3ABA, p 1672.

32 4ABA, p 2362; NE Day 7, p 12.

33 3ABA, p 2166.

34 See NE Day 9, p 23.

Expert evidence

24 Apart from Dr Leong who provided the court with the Independent Assessor's Report, Prof Gutmann, Prof Schultz and Dr Moinpour were called by the parties to give expert evidence. I note that each party attempted to cast doubt on the expertise and/or neutrality of the other side's expert witnesses, while, unsurprisingly, defending the expertise and neutrality of their own. I will therefore start by providing some preliminary observations on the parties' contentions surrounding the expert evidence, before going into the substantive issues of the case.

25 As I recently described in greater detail in *Lee Tat Cheng v Maka GPS Technologies Pte Ltd* [2017] SGHC 48 ("*Lee Tat Cheng*") at [28]–[35], the role of an expert in legal proceedings involving patent law is to aid the court in its determination of questions of law and fact. Experts are almost always called in patent invalidity and patent infringement proceedings, in particular, to assist the court in viewing the patent claims through the eyes of the person skilled in the art at the time the patent was applied for – *ie*, the "notional skilled reader". And certainly, expert witnesses must be "properly qualified" (*Mühlbauer* ([19] *supra*) at [19]). The learned authors of *A Guide to Patent Law in Singapore* (Alban Kang gen ed) (Sweet & Maxwell, 2nd Ed, 2009) ("*Kang*") observe at para 7.2.9 that "[a]s far as possible, the experts should possess the relevant technical knowledge or experience".

26 Above all, an expert is not an advocate for the party retaining him, and "his advocacy is limited to supporting his independent views and not his client's cause" (*Vita Health Laboratories Pte Ltd and others v Pang Seng Meng* [2004] 4 SLR(R) 162 ("*Vita Health*") at [83]). Order 40A r 2 of the ROC expressly states that the expert's duty to the court "overrides any obligation" to his client.

The expert must "remain detached from the fray and should not have any interest in the outcome of the proceedings nor partiality to the facts in issue" (*Vita Health* at [80]). Nonetheless, the Court of Appeal in *Mühlbauer* noted at [44] that the difficulties engendered by the issue of bias with regard to experts "are, unfortunately, perennial in nature". The present case is no exception. The relevant test for determining whether an expert's evidence should be discounted is one of *actual* partiality, rather than the mere *appearance* of partiality (*Mühlbauer* at [47]). An expert need not be independent, and may even be an employee of one of the parties in appropriate circumstances (see David Llewelyn, "The Use of Experts in Legal Proceedings in Singapore Involving Intellectual Property Rights" (2013) 25 SAcLJ 480 ("*Llewelyn*") at para 26; *Lee Tat Cheng* at [35]). However, he must be neutral and impartial in giving his evidence. With these principles in mind, I turn to consider the parties' submissions on the reliability of the three expert witnesses I heard at trial.

Prof Schultz

(1) The Defendants' contentions

27 The Defendants raise contentions with regard to both of the Plaintiff's expert witnesses. For Prof Schultz, the Defendants essentially contest his qualifications and experience. They relied on Prof Schultz's admission during cross-examination that he did not have experience in CMP "beyond very rudimentary things", and that he had not done research on integrated circuits ("IC") or CMP.[35] Prof Schultz also testified that prior to being engaged by the Plaintiff for this case, he did not understand the conditioning process for CMP pads, but that he became more familiar with the process later on.[36] The

35 NE Day 3, pp 18–19.

36 NE Day 3, p 54.

Defendants point to Prof Gutmann's description of the "notional skilled reader" in this context as being someone with at least five years' experience in IC processing and at least three years' experience in CMP. The Defendants assert that Prof Schultz's experience fell short of this standard.[37]

28 Moreover, the Defendants point out their observations at trial that Prof Schultz was unprepared in terms of his familiarity with the Patent and his own expert report.[38] According to the Defendants, he was unclear and inconsistent about the meanings of terms such as "work surface" and "working environment". His unfamiliarity with the NexPlanar Pads manufactured by the 1st Defendant was evident from his erroneous statement that the NexPlanar Pads were "sliced pads [with] open microelements", especially as it contradicted a reference in his expert report to a presentation made by the 1st Defendant.[39]

29 Most importantly, the Defendants allege that Prof Schultz was partial and that he gave evidence simply to defend the Plaintiff's positions, making his answers during cross-examination sometimes inconsistent or illogical.[40] The Defendants characterise his testimony as inconsistent as to whether the term "work surface" simply refers to the top surface of the polishing pad, and even suggest that he was coached to give certain answers that were consistent with the Plaintiff's positions. The Defendants claim that Prof Schultz's *volte-face* in his answers regarding the term "work surface" during cross-examination was in the light of his realisation that his original position would be detrimental to the Plaintiff's case. Further, he admitted that he did not realise that his expert

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37 Ds' Closing Submissions, para 39.

38 Ds' Closing Submissions, para 45.

39 Ds' Closing Submissions, paras 45–46.

40 Ds' Closing Submissions, para 45.

opinion should not have been influenced by suggestions from other parties. He also admitted that the authoring of his infringement analysis report and certain other reports annexed thereto involved significant collaboration with Mr Biederman and Mr David James, who were employees of Dow Chemical and/or the Plaintiff.[41]

(2) My findings

30 I am cognisant of the concerns raised by the Defendants, especially with regard to Prof Schultz's relatively limited experience with CMP and IC processing, and the fact that his expert report was essentially co-authored by the Plaintiff's representatives.[42] Nonetheless, there is no need for me to overemphasise these concerns as Dr Leong's appointment by the court as an independent assessor was meant to address several of these issues. Where the Independent Assessor's Report covered repeats of tests reported in Prof Schultz's infringement analysis report, I primarily relied upon the evidence presented by Dr Leong. In any event, I note that Dr Leong's evidence was largely in agreement with the findings in Prof Schultz's report (see [214] below). Further, it was remarked at para 26 of *Llewelyn* ([26] *supra*) that an expert witness need not himself be skilled in the art in question, although he usually is. The important question is whether the expert is able to assist the court in viewing the patent claims through the eyes of the hypothetical skilled reader (see *Lee Tat Cheng* ([25] *supra*) at [39]). As for the Defendants' contentions regarding the design and inherent limitations of Prof Schultz's tests that were later repeated by Dr Leong, I will consider them where appropriate when assessing the probative value of the evidence in the Independent Assessor's

41 NE Day 3, pp 20–21, 47–48, 52–53.

42 Ds' Closing Submissions at para 44(e).

Report below. I will also discuss my views on Prof Schultz's inconsistency on terms such as "work surface" and "texturized work surface" when dealing with the issue of claim construction below.

Prof Gutmann

(1) The Defendants' contentions

31 Whereas Prof Schultz gave expert evidence relating to infringement of the Patent, Prof Gutmann's evidence was in respect of validity issues – in particular, the "inventive step" and "sufficiency" requirements. The Defendants do not challenge Prof Gutmann's experience and qualifications, but argue that his "overzealous" defence of the Plaintiff's position undermined his neutrality and reliability as an expert witness. Specifically, the Defendants point to Prof Gutmann's attempts to provide his opinion on matters which he had no expertise in, such as the manufacturing of polyurethane pads and the viability of using certain methods to incorporate different microelements and microspheres into polishing pads.[43] Prof Gutmann also acknowledged during cross-examination that he was "over-insisting" on his interpretation of a certain paragraph in the specification for the Japanese Patent.[44] The Defendants characterise such "over-insistence" by an independent expert as being unfair.[45]

32 The Defendants also take issue with Prof Gutmann's failure to disclose in his AEICs that he was previously engaged by the Plaintiff as an *ad hoc* consultant between February and December 2007, which raises a question as to his independence. Notwithstanding Prof Gutmann's reasons that his

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43 Ds' Closing Submissions, para 50.

44 Ds' Closing Submissions, para 49; NE Day 5, p 37.

45 NE Day 5, p 38.

consultancy work with the Plaintiff was extremely limited and only involved issues on CMP slurries and not CMP pads, he conceded in hindsight that he should have highlighted this in his AEICs.[46]

33 Finally, the Defendants cast doubts upon the independence of Prof Gutmann's evidence in the light of his admission that Annexure XVIII to his supplemental AEIC dated 7 November 2016, a table comparing the Patent to the alleged prior art, was initially drafted in part by Mr Biederman.[47]

(2) My findings

34 Upon considering the above contentions, I do not find Prof Gutmann to be "a hired gun" as the Defendants posit. On the whole, his testimony did not amount to an overzealous defence of the Plaintiff's positions, nor did he repeatedly insist on taking indefensible positions simply to further the Plaintiff's case. As the Defendants themselves point out in their closing submissions, Prof Gutmann was willing to make certain concessions regarding his view that a skilled person would be encouraged to try "Expancel" microspheres in CMP pads, which was a fair admission that did not advance the Plaintiff's case on inventive step. I also do not find it especially troubling that the table in Annexure XVIII was initially drafted by Mr Biederman, as it appears that Mr Biederman's input mainly related to the way in which certain key features of the Patent and the alleged prior art were presented, and did not seem to negatively influence Prof Gutmann's expert opinion as to the inventiveness of the Patent. While I agree that Prof Gutmann should have disclosed his past consultancy work with the Plaintiff at the outset, I have explained at [26] above that there is no strict requirement as to the independence of an expert witness,

46 NE Day 5, pp 3 and 10–11.

47 Ds' Closing Submissions, para 48; NE Day 4, pp 11–12.

who in certain circumstances may even be an employee of one of the parties to the action. With that said, I must add that I was cognisant of the need to read Prof Gutmann's reports and evidence more critically in the light of his past work for the Plaintiff, so as to be alert to signs of any undue eagerness to force a point in the Plaintiff's favour.

35 Assertions of bias against expert witnesses are serious allegations which require a showing of actual partiality; the mere appearance of partiality does not suffice (*Mühlbauer* ([19] *supra*) at [47]). There was simply no sufficient basis here for me to find any actual partiality by Prof Gutmann, and his evidence did indeed assist the court in viewing the claims of the Patent through the eyes of the hypothetical skilled reader.

Dr Moinpour

(1) The Plaintiff's contentions

36 On the other hand, the Plaintiff similarly seeks to discredit the Defendants' expert witness, Dr Moinpour. The Plaintiff's first contention is that Dr Moinpour is not a properly qualified expert in the field of CMP pads, as he has no experience in CMP pad manufacturing and only became involved with CMP pads around 1994. He therefore has no personal knowledge of the state of the art prior to the priority date of 19 August 1992, including the problems associated with the "IC-60" pad. The Plaintiff submits that his opinion on "obviousness" would be tainted by hindsight knowledge.[48]

37 The Plaintiff also argues that Dr Moinpour's expert report was replete with unsubstantiated opinions and speculative remarks, and notes that he

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48 P's Closing Submissions, para 196.

acknowledged during cross-examination that he did make a speculative remark about a study report on defect density by his former colleague, Mr Sam Louke ("Mr Louke"). Dr Moinpour also offered no reasons when advancing his opinion that the Japanese Patent implicitly discloses the hardness or softness variations of the pad as a result of exposure of microelements to the working environment.[49]

38 Finally, the Plaintiff submits that Dr Moinpour was not impartial and did not even appear to be so. At trial, he was seen passing notes to the Defendants' counsel during the cross-examinations of Prof Schultz and Prof Gutmann. His *curriculum vitae* and AEIC did not disclose the fact that he was a "technical mentor" to the 1st Defendant, and it only transpired during cross-examination that he had provided the 1st Defendant with technical input pursuant to his responsibility in Intel to develop opportunities for its materials suppliers. Dr Moinpour was involved with the 1st Defendant as part of the team of technical experts and engineers, which suggests to the Plaintiff a close relationship between the 1st Defendant and Dr Moinpour, and between the 1st Defendant and Intel.[50]

(2) My findings

39 I will consider each of the Plaintiff's contentions in turn. First, the fact that Dr Moinpour did not work in CMP at the time of the priority date does not, in my view, affect his credibility as an expert. I do not think it is fair to say that an expert cannot give a reasonably informed view as to the state of the art at the time of the priority date, simply because he acquired his expert knowledge only at a later time. An expert like Dr Moinpour may still be able give useful evidence

[49] P's Closing Submissions, paras 197–200.

[50] P's Closing Submissions, paras 206–212.

as to the problems that existed at the time, and especially so if he says that the problems still exist today. Experts frequently refer to the state of science, applied research, technical and industrial knowledge as they existed at points in time long ago and certainly well before they entered the relevant field. The question is whether they possess the expertise and knowledge such that they are able to assist the court to assess the relevant prior art and to interpret the claims from the perspective of the skilled reader at the relevant time.

40 As for the aspersions cast by the Plaintiff upon the contents of Dr Moinpour's report, I will consider each of these points separately as and when they arise during my substantive analysis. Needless to say, Dr Moinpour's opinions, like those of the other experts, will have to be evaluated against the rest of the evidence including other expert reports. For now, taking a broad view, I consider that Dr Moinpour's evidence was generally helpful to the court in its task of viewing the Patent through the eyes of the skilled reader.

41 I agree that Dr Moinpour should have expressly and clearly stated his past connections with the 1st Defendant in his AEIC, and that he should have been more upfront and forthcoming about this fact. That said, during cross-examination and re-examination, he explained his role at Intel and stated that he was involved as part of the team of technical experts at Intel that championed or mentored companies including the 1st Defendant. I am not prepared to draw an adverse inference against Dr Moinpour's evidence from this *per se*, but as with Prof Gutmann, this makes it necessary to go over Dr Moinpour's reports and testimony even more critically.

Issues to be determined

42 Having discussed my preliminary observations on the expert evidence, I now broadly set out the main issues for this court's determination:

(a) the validity of the Patent – specifically, whether the Patent was novel, involved an inventive step, and sufficiently disclosed the invention;

(b) if the Patent was valid, whether it was infringed by the Defendants' CMP pads and actions; and

(c) if so, the appropriate remedies for infringement.

Validity of the Patent

43 I turn to the first issue of whether the Patent was valid prior to its expiry in 2013. The grounds on which the validity of a granted patent can be attacked are well-known and can be found in s 80(1) of the Patents Act (Cap 221, 2005 Rev Ed). Of particular relevance to the present case are: (i) the invention is not a patentable invention (s 80(1)(*a*)); and (ii) the specification of the patent does not disclose the invention clearly and completely for it to be performed by a person skilled in the art (s 80(1)(*c*)).

Is the invention patentable?

44 Section 13(1) of the Patents Act sets out the three requirements for an invention to be patentable:

(a) The invention must be new (s 13(1)(*a*)).

(b) The invention must involve an inventive step (s 13(1)(*b*)).

(c) The invention must be capable of industrial application (s 13(1)(*c*)).

Only the first two requirements of "novelty" and "inventive step" are in contention in the present suit, and I will consider novelty first.

Novelty

(1) The legal principles

(A) THE STATE OF THE ART

45 The law on novelty is set out in s 14 of the Patents Act. Section 14(1) first provides that "[a]n invention shall be taken to be new if it does not form part of the state of the art". Section 14(2) sets out the definition of the "state of the art":

> The state of the art in the case of an invention shall be taken to comprise all matter (whether a product, a process, information about either, or anything else) which has at any time before the priority date of that invention been made available to the public (whether in Singapore or elsewhere) by written or oral description, by use or in any other way.

46 The basic principles on what constitutes the state of the art for the purposes of assessing patentability are well-established and can be briefly set out. Section 14(2) makes it clear that the state of the art is assessed on a worldwide basis with no geographical or territorial limits. It comprises "all matter" made available to the public before the priority date. In the present case, the priority date claimed under s 17 of the Patents Act was 19 August 1992. It follows, for example, that the state of the art would include an article that was published in 1982 in Brazil. Matter will form part of the state of the art so long as it has "been made available" to the public. It does not matter where the matter is situated or how the information was made available. There is no requirement

that the disclosure must be in writing or reduced to a material record. Oral disclosures taking place anywhere in the world count just as much as an oral disclosure in Singapore or a written disclosure made in Japan. Indeed, the state of the art may include information made available to the public simply due to a use of the product in public view.

47 There is no requirement that the information must actually have been accessed or come to the attention of an actual member of the public (*Institut Pasteur and another v Genelabs Diagnostics Pte Ltd and another* [2000] SGHC 53 ("*Genelabs* (HC))" at [188] *per* Tay Yong Kwang JC (as he then was)). The focus is on whether the information had been *made available*. It is well-established that it is enough if the information has been made available to at least one member of the public who was free in law and equity to use it (see *First Currency Choice Pte Ltd v Main-Line Corporate Holdings Ltd and another appeal* [2008] 1 SLR(R) 335 ("*First Currency Choice*") at [38] and *Dien Ghin Electronic (S) Pte Ltd v Khek Tai Ting (trading as Soon Heng Digitax)* [2011] 3 SLR 227 ("*Dien Ghin Electronic*") at [29] *per* Chan Seng Onn J). The position is the same in the UK (see, for example, *Fomento Industrial SA v Mentmore Manufacturing Co Ltd* [1956] RPC 87 at 99–100 and *PLG Research Ltd v Ardon International Ltd* [1993] FSR 197 at 226).

48 The state of the art is thus potentially enormous, especially given that there is no need for any formal or express description of the information such as by way of an article, a scientific paper or a verbal description at a conference. Where a product is demonstrated or simply used in a public setting, the "demonstration" or "use" is something that has been made available to the public. In some cases, the demonstration or use may be sufficient to make the information (embodied in the product) available, so as to place the claimed

invention into the prior art (see, for example, the English cases of *Lux Traffic Controls Limited v Pike Signals Limited* [1993] RPC 107 at 133–135; *Milliken Denmark AS v Walk Off Mats Ltd* [1996] FSR 292 at 309–312; and *Kavanagh Balloons Pty Ltd v Cameron Balloons Ltd* [2004] RPC 5, cited by the Defendants). That said, the question as to what information is made available by a prior use can be the subject of considerable dispute. Whilst much will depend on the circumstances, put broadly, the question to be asked is: what would the notional skilled reader who witnesses the prior use (as the universal fly on wall) be able to describe about the use? Would that description amount to an enabling description?

(B) CONFIDENTIAL DISCLOSURES

49 Novelty has been described as a formidable requirement and that the law of anticipation is strict to the patent proprietor (see *Genelabs* (HC) at [188]). The burden, however, is on the party challenging the novelty of a granted patent to adduce evidence of a prior disclosure that led to the claimed invention forming part of the state of the art (*Martek Biosciences Corp v Cargill International Trading Pte Ltd* [2012] 2 SLR 482 at [44] *per* Tay Yong Kwang J (as he then was)).

50 The disclosure of information under the cover of an obligation of confidence is a non-prejudicial disclosure. It does not have the effect of placing the information into the state of the art (*Hunter Manufacturing Pte Ltd and another v Soundtex Switchgear & Engineering Pte Ltd and another appeal (No 1)* [1999] 3 SLR(R) 1108 at [53]).

51 Whilst an obligation of confidence is often based on the terms of a contract, the duty is not dependent on contract. In appropriate cases, it can be

imposed by equity pursuant to equitable principles of good faith (see *Coco v AN Clark (Engineers) Limited* [1968] FSR 415 ("*Coco v Clark*") at 419–420, which has been followed and applied in numerous decisions in Singapore including *X Pte Ltd and another v CDE* [1992] 2 SLR(R) 575 at [27] and *Invenpro (M) Sdn Bhd v JCS Automation Pte Ltd and another* [2014] 2 SLR 1045 at [129]).

52 The basic principles as to when equity will impose a duty of confidence are well-known. In many cases, the duty arises in the context of a disclosure of confidential information during business negotiations or discussions with some avowed common goal in mind such as a possible joint venture arrangement (see *Coco v Clark* at 421). That said, the question as to whether a duty of confidence should be imposed depends very much on the circumstances. Given the relevance of this point to the case at hand, a few case law examples may be instructive.

53 In *Pall Corp v Commercial Hydraulics (Bedford) Ltd* [1990] FSR 329 ("*Pall Corp*"), the English Patents Court considered whether the patent in suit was anticipated by the supply of membrane samples to a potential customer, Motorola, and five other companies for testing. The court found that the evidence established that the samples supplied to Motorola were experimental and secret, and no details of their nature or construction were disclosed. The supply of the samples to Motorola was therefore not an enabling disclosure of the invention claimed in the patent. Similarly, the membrane samples sent to the other five companies were sent under conditions of confidence, either express or otherwise clearly understood and accepted, and the recipients knew that the membrane samples were experimental and secret. The English Patents Court held that the samples had not been made available to the public and did not anticipate the patent in suit (*Pall Corp* at 348).

54 *Strix Ltd v Otter Controls Ltd* [1995] RPC 607 ("*Strix*") was an English Patents Court case which related to the plaintiff's patent for a back-up control for electric kettles. Although there was no express agreement between the plaintiff and the recipient Philips that the information supplied should be kept confidential, the court nonetheless held that an obligation of confidence could be inferred from the references to confidentiality in certain letters between the plaintiff and Philips, and also implied from the general circumstances of the transaction. The court took into account the fact that a high degree of cooperation and coordination between the plaintiff and Philips was required in order for Philips to design and assemble a particular kettle using controls devised by the plaintiff. From this, the court found that the plaintiff and Philips must have intended for their obligations of confidence to exist until the release of the new kettle onto the market, which was after the priority date of the patent in suit (*Strix* at 633–634).

55 However, in *Aga Medical Corporation v Occlutech (UK) Ltd* [2015] RPC 12 ("*Aga Medical*"), the English Patents Court found no equitable obligations of confidence in the prior disclosure of a patented medical evidence to doctors at the hospital where clinical trials of the device were carried out. There was no suggestion that the doctors to whom the invention was disclosed ever signed any confidentiality undertaking, and the disclosure was not on a business-like basis with a common commercial object in mind (*Aga Medical* at [48], citing *Coco v Clark* at 421). Similarly, the English Patents Court in *Thoratec Europe Limited v AIS GmbH Aachen Innovative Solutions* [2016] EWHC 2637 (Pat) ("*Thoratec*") found no confidentiality in the prior use by doctors supplied with a medical device to carry out studies. In *Thoratec*, there was no confidentiality agreement, whilst there was evidence, *inter alia*, that the

device was aggressively marketed and demonstrated at conferences before the priority date ([167]–[168] and [173]).

56 Yet another decision is *Carflow Products (UK) Limited v Linwood Securities (Birmingham) Limited* [1996] FSR 424, in which the confider showed a prototype of a locking device for a car steering wheel during discussions over possible manufacture and sale. No express bar of confidentiality was imposed. A non-disclosure agreement was not signed. Following *Coco v Clark,* the question postulated was whether a reasonable man would have regarded the information as being revealed in circumstances such as to generate a duty of confidence in equity on a good faith basis (at 429–430). On the facts of the case, Jacob J did not think so, reasoning (at 429–430) that:

> People are habitually showing things they have designed or invented to would-be manufacturers. If the latter are put under an obligation of confidence merely by seeing a prototype—which they would as reasonable men know could be the subject of independent protection, then they would be far less willing to look at things. The reasonable man will not look at the transaction myopically, blinding himself to the panoply of potential intellectual property rights the law provides.

In short, the English High Court found that since the reasonable man in the circumstances might think that the confider had chosen to protect the invention using statutory intellectual property rights (such as design rights or patents), he would not necessarily think that an obligation of confidentiality was being imposed.

57 To summarise, the above cases clearly illustrate that the court may find the existence of an obligation of confidence even in the absence of an express confidentiality undertaking or agreement. In reaching this determination, the court will consider all the circumstances in which the disclosure was made,

including the purpose of the disclosure and whether there was a common commercial object and/or substantial cooperation between the recipient and the proprietor of the patent. In addition, I briefly note that ss 14(4)(*a*) and (*b*) of the Patents Act further provide that prior disclosure shall be disregarded if made as a result of a "breach of confidence".

(C) ANTICIPATION

58 Having identified the prior disclosure or prior art, the next step is to determine whether the claimed invention was anticipated by said prior disclosure or prior art (see Ng-Loy Wee Loon, *Law of Intellectual Property of Singapore* (Sweet & Maxwell, 2nd Ed, 2014) ("*Ng-Loy*") at para 30.1.25; *Lee Tat Cheng* ([25] *supra*) at [76]–[77]). Numerous pithy statements have been used in past cases to describe what does or does not amount to anticipation. These include the oft-cited statement by Sachs LJ from *General Tire & Rubber Company v Firestone Tyre & Rubber Company Limited* [1972] RPC 457 ("*General Tire*") at 486 that "[a] signpost, however clear, upon the road to the patentee's invention will not suffice. The prior inventor must be clearly shown to have planted his flag at the precise destination before the patentee." As is often remarked, a near-miss does not amount to anticipation.

59 A commonly-cited test for anticipation is the "would it infringe" test set out in *General Tire* at 485–486 by Sachs LJ. The test postulates that if a prior art document, *etc*, contains a clear description of or instructions to do or make something that would infringe the patentee's claim if carried out after the grant of the patent, the patentee's claim lacks novelty and is anticipated. This test, sometimes described as "reverse infringement", was accepted by Chan Seng Onn J in *Dien Ghin Electronic* ([47] *supra*) at [30]. If a patent was granted or

upheld in these circumstances, the effect would be that something which was in the prior art (available to the public) would be taken out of the state of the art.

60 In *Mühlbauer* ([19] *supra*), the Court of Appeal also stated at [17], citing *Genelabs Diagnostics Pte Ltd v Institut Pasteur and another* [2000] 3 SLR(R) 530 ("*Genelabs* (CA)") at [24] and Ng-Loy Wee Loon, *Law of Intellectual Property of Singapore* (Sweet & Maxwell Asia, Rev Ed, 2009) at para 30.1.38, that:

> … [T]he prior publication must not only identify the subject matter of the claim in the later patent but must also be an *enabling disclosure*. This means that an invention would be anticipated by a piece of prior art if the teachings disclosed in this prior art are sufficiently clear and complete to allow the skilled addressee to make the invention.
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> [emphasis added, internal citations omitted]

61 The "enabling disclosure" test was approved by the Court of Appeal in *Merck & Co Inc v Pharmaforte Singapore Pte Ltd* [2000] 2 SLR(R) 708 ("*Merck*") at [38]. The teachings in the disclosure must inevitably lead to the invention in the sense that it must enable the skilled addressee to make the invention. A disclosure which does not enable the skilled addressee to perform the claimed invention is not anticipatory.

62 Finally, for completeness, I add that "mosaicking" of the prior art is impermissible for the purposes of the novelty inquiry; the claimed invention must be compared against each individual piece of prior art separately to determine whether it was anticipated by each piece of prior art (*Mühlbauer* at [18]). This is unless the prior art document itself refers to another document in the state of the art.

63 It follows from the above that there are essentially four steps in the assessment of novelty.

(a) The first step is to determine the state of the art as at the priority date based on the evidence and material before the court.

(b) The second step is to interpret the prior art material from the perspective of the skilled reader at the date the material or information entered the prior art and without use of hindsight and mosaicking. What does each piece of the prior art disclose?

(c) The third step is to interpret the scope of the claimed invention from the perspective of the skilled reader and by reference to the patent specifications.

(d) The fourth step is to compare the prior art against the claimed invention and to reach a determination as to whether the prior art anticipates the claimed invention.

64 I turn now to consider the claim that the claimed invention lacked novelty. The attack rests on the prior use and sale of the Plaintiff's own "IC-1000" pads to Intel before the Patent's priority date of 19 August 1992.

(2) The parties' positions on whether the Patent was anticipated by the prior use and sale of the "IC-1000" pads

65 Counsel for the parties have helpfully set out the common ground and distilled the main issue of dispute, which is whether the Plaintiff's prior sale and disposal of its "IC-1000" pads were made under obligations of confidentiality, such that the Patent was not anticipated by the disclosure. The parties are in agreement on the fact that the Plaintiff sold about 500 "IC-1000" pads to Intel

New Mexico, Intel Oregon, Intel California and Rodel Products Corporation between 15 March 1991 and 11 August 1992. The Plaintiff also did not dispute that these "IC-1000" pads fell within the claims of the Patent, or that the prior sales to Intel were "enabling disclosures" that were sufficiently clear and complete to enable a skilled addressee to make the invention.[51]

66 The Defendants thus submit that the Patent was anticipated by:

(a) the sale of the "IC-1000" pads to Intel between March 1991 and August 1992, which was before the priority date;

(b) the disclosure of samples of "IC-1000" pads to SEMATECH, a non-profit consortium that performs research and development to advance chip manufacturing ("Sematech"), and/or presentations covering "IC-1000" pads at a Sematech conference on 30 and 31 July 1991; and

(c) the Plaintiff's alleged provision of the Brochure around May or June 1992 to Mr Cadien (while he was at Intel) by an unnamed employee of the Plaintiff.

67 On the other hand, the Plaintiff submits that the Patent was not anticipated by the prior use and sale of the "IC-1000" pads for the following reasons:

(a) First, the "IC-1000" pads sold to Intel before the priority date were *experimental* versions of the Patent.

(b) Secondly, the sale was made pursuant to or in relation to a joint development venture between the Plaintiff and Intel. Intel was under an

[51] Ds' Closing Submissions, paras 152–155.

express obligation of confidentiality owed to the Plaintiff in respect of the venture and the sale.

(c) In the alternative to (b), Intel was under an *implied obligation* of confidentiality to the Plaintiff in respect of the venture and the sale.

(d) Furthermore, the joint venture to develop a CMP pad created a *special relationship* between the Plaintiff and Intel, and consequently, Intel was not representative of the public at large when it acquired information regarding the Patent. This created an obligation of confidentiality owed by Intel to the Plaintiff.

The Plaintiff similarly maintains that any disclosures to Sematech or at the Sematech conference were confidential, and contends that it did not provide Mr Cadien with the Brochure at any time before the priority date.

(3) Facts surrounding the development of the "IC-1000" pads

68 It may be useful to first set out a background of the dealings between the Plaintiff and Intel before and around the priority date of the Patent.

69 Based on Mr McClain's evidence, the Plaintiff manufactured polishing pads known as "IC-40" and "IC-60" pads in 1991. These pads contained "Q-Cel 300" hollow glass microspheres, and were originally and predominantly used in glass polishing. The "IC-40" and "IC-60" pads were among the Plaintiff's main products around 1991. At or around this time, the CMP industry was just getting off the ground in terms of its use on semiconductor wafer products. Intel was one of the Plaintiff's customers that ordered the "IC-60" pads.[52]

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[52] NE Day 1, pp 34, 35, 38 and 52.

70 Somewhere around late 1989 to early 1991, the Plaintiff was concentrating on trying to refine the "IC-60" pads. A problem highlighted by its customers at the time was the scratching of the wafer, which may have been caused by the fracturing of the microspheres in the existing pads. Such scratching rendered the wafers defective.[53] In January 1991, Mr McClain's team experimented with using different brands and types of microelements, such as "Q-Cel" microelements, and different densities of "Expancel" microspheres.[54] Mr McClain's team also experimented with varying the type of pre-polymer used in the "IC-60" pads to see if this would address the scratching problem.[55] The experimental pads were marked under the "X-HGM" series. "X" stands for "experimental", while "HGM" are the initials of Mr Harry George McClain.[56] "Expancel" microspheres are discussed in greater detail later under inventive step. The general point I make is that the Plaintiff was looking at or trying different types of microspheres, including those which were of a flexible nature.

71 According to Mr McClain's recollection, four versions of experimental pads made between 28 February 1991 and 2 March 1991 were sent to Intel.[57] One version, created on 2 March 1991, was marked "X-HGM-1128". It appears that the "X-HGM-1128" pads correspond to the "IC-1000" pads that were sold to Intel. A shipment analysis report shows that Intel bought about 500 pads corresponding to the product code "XHGM1128, IC1000" from the Plaintiff from March 1991 to August 1992.[58]

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53 NE Day 1, pp 81 and 84.

54 NE Day 1, pp 84 and 89.

55 NE Day 1, p 85.

56 AEIC of Mr McClain, para 10.

57 NE Day 1, pp 89–90.

58 AEIC of Mr Biederman, BTB-16.

(4) Whether Intel owed the Plaintiff an express obligation of confidence

72 I first consider the question of whether Intel owed the Plaintiff an express obligation of confidence. According to the Plaintiff, it had a joint development venture with Intel in 1991 concerning experimental versions of the "IC-1000" polishing pads.[59] The Plaintiff claims that three confidentiality agreements existed between the Plaintiff and Intel:

(a) a "confidential disclosure agreement" covering the "IC-1000" pad samples ("the CDA");

(b) a "confidential joint development agreement" which contained an 18-month exclusivity period in favour of Intel ("the JDA"); and

(c) a corporate "non-disclosure agreement" dated 30 April 1992, which was Intel's standard confidentiality agreement ("the NDA").

73 The Plaintiff's biggest hurdle in this regard is that it is unable to produce copies of the CDA and the JDA, as these agreements have purportedly gone missing. The Plaintiff however argues that Intel is a company well-known for being very methodical about preserving confidential information, and both the Plaintiff and Intel had information that they had strong interests in protecting. Based on this, as well as the common practice in the semiconductor industry of entering into confidential agreements, the CDA and the JDA must have in all likelihood existed. It would have been implausible for the Plaintiff and Intel not to enter into such confidentiality agreements. Further, Mr Roberts clearly

[59] P's Closing Submissions, paras 99–100; AEIC of Mr Roberts, paras 8–17.

testified to the existence of both agreements, while Ms Koppenbrink stated that she recalled seeing the JDA.[60]

74 Unsurprisingly, the Defendants challenge the Plaintiff's assertions as to the very existence of these agreements. The Plaintiff's factual witnesses were unaware of the dates when the agreements were signed and/or who had signed on behalf of the Plaintiff, let alone the terms of these agreements. The Defendants also point out that the Plaintiff did not mention the CDA at all in its pleadings or during general discovery in this suit. Moreover, it would have made no sense for the Plaintiff and Intel to sign the NDA if the other two agreements had truly existed.[61]

75 The sale of the experimental "IC-1000" polishing pads to Intel took place a long time ago when the Plaintiff was known as Rodel Holdings Inc. Whilst CMP technology and polishing pads were not new, the use of CMP technology in the integrated circuit industry was relatively new. The late 1980s and early 1990s were also a time when the home computer industry was taking off with new high-performance lower-cost microprocessors from companies such as Intel entering the market. The evidence was that existing polishing pads did not work well on silicon wafers, causing problems with uniformity and scratching.[62]

76 This was the background against which the Plaintiff made the experimental "IC-1000" polishing pads that were sold to Intel between March 1991 and August 1992. Whilst the Plaintiff asserts that a CDA and a JDA had

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60 NE Day 2, p 22.

61 Ds' Closing Submissions, paras 200–206.

62 NE Day 1, pp 71 and 81.

been signed with Intel, it is surprising that the Plaintiff could not find a copy of either. The importance of a CDA or JDA must have been clear to the Plaintiff and Intel. Indeed, there is clear evidence Intel had strong concerns over confidentiality.[63] It would logically make sense for the Plaintiff and Intel to have entered into some sort of confidentiality agreement. The problem is that even if they had entered into some form of JDA, the exact terms and dates of any such agreement could not be put before me. It would be speculative to presume that the express terms provided for an obligation on Intel's part to ensure the confidentiality of the "IC-1000" pads.

77 The NDA, on the other hand, was exhibited to the court. However, this was signed on 30 April 1992, and thus post-dated most of the sales of the "IC-1000" pads to Intel. The terms of the NDA did not refer to the "IC-1000" pads that had already been sold to Intel.

78 As such, on the basis of the available evidence, I am unable to recognise the existence of any express confidentiality undertaking or agreement providing for an obligation of confidence in respect of the "IC-1000" pads sold to Intel.

(5) Whether Intel owed the Plaintiff an implied obligation of confidence

79 While there may not have been an express confidentiality undertaking, this does not rule out the possibility that Intel nonetheless owed the Plaintiff an *implied* obligation of confidence. As Megarry J remarked in *Coco v Clark* at 421, it is likely that the recipient is bound by an equitable obligation of confidence "where information of commercial or industrial value is given on a business-like basis and with some avowed common object in mind, such as a joint venture or the manufacture of articles by one party for the other".

63 P's submissions, para 109.

80 The Plaintiff submits that its relationship with Intel was exactly what was envisioned by Megarry J's remarks. It had a common object with Intel when they entered into the joint venture in 1991. The Plaintiff's purpose of supplying the experimental "IC-1000" pads was so that it could obtain performance data from Intel. In exchange, Intel would have a head-start over the rest of the industry, as it would have worked with the experimental pads prior to any commercial launch. Additionally, the Plaintiff cited *Zipher Ltd v Markem Systems Ltd* [2009] FSR 1 at [244] for the proposition that a person "who acquires information by virtue of a special relationship is not representative of the public at large". The Plaintiff asserts that because Intel acquired information about the "IC-1000" pads by virtue of its special relationship with the Plaintiff, there was no prior disclosure to the public.

81 The Defendants argue that there was no joint development project between the Plaintiff and Intel to develop the "IC-1000" pads. Instead, the advent of the "IC-1000" pads was more likely a result of Mr McClain's team working to make polishing pads to assuage and retain Intel as a customer in light of its complaints about scratching and surface defects.

82 Considering all the circumstances of the disclosure, I am of the view that there was an implied obligation of confidence between the Plaintiff and Intel. While I hesitate to use the term "joint venture" to describe the relationship between the Plaintiff and Intel, it is clear to me that information of commercial or industrial value was indeed being given on a business-like basis and with a common object in mind. The common object was the improvement of the existing "IC-60" pads to solve the scratching problem, and I agree with the Plaintiff's view that there were mutual benefits to be reaped by both sides. At the very least, there was a "project" between Intel and the Plaintiff, as described

by Mr Louke of Intel.[64] This provides a useful starting point which suggests that Intel was most likely bound by an obligation of confidence (see *Coco v Clark* at 421).

83 In *Coco v Clark,* it was held that a touchstone for the imposition of a duty of confidence in equity (outside of contract) is the common law reasonable man. Megarry VC stated at 420–421 that:

> It may be that that hard-worked creature, the reasonable man, may be pressed into service once more; for I do not see why he should not labour in equity as well as at law. It seems to me that if the circumstances are such that *any reasonable man standing in the shoes of the recipient of the information would have realised that upon reasonable grounds the information was being given to him in confidence*, then this should suffice to impose upon him the equitable obligation of confidence.
>
> [emphasis added]

84 In applying the test of whether "[a] reasonable man standing in the shoes of the recipient of the information would have realised that upon reasonable grounds the information was being given to him in confidence", I consider both the nature of the information communicated, as well as the circumstances in which the information was communicated.

(a) I accept that the "XHGM-1128" or "IC-1000" pads were experimental in nature. Given that these experimental pads were developed by Mr McClain and his team over a period of testing with different microelements and pre-polymers, I find that the information communicated to Intel did in fact have a "necessary quality of confidence about it" (see *Coco v Clark* at 419). The Plaintiff points out that the Defendants themselves redacted the data of their own CMP

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64 2ABA, p 1144.

Pads, which reinforces the notion that such data is likely to be highly confidential. The Plaintiff was one of the leaders in manufacturing polishing pads at the time, and the CMP industry was in its formative years. I see no reason why either the Plaintiff or Intel would have wanted such information to be disclosed to the world at large.

(b) As for the circumstances in which the information was imparted, I find on the balance of probabilities that they imported an obligation of confidence (see *Coco v Clark* at 419–420). Mr Cadien testified that Intel stored its "IC-1000" pads in its research facilities, which were off-limits to outsiders.[65] Subsequent presentations about the "IC-1000" pads were only made at a conference which was expressly stated to be "confidential" (see [89] below).[66] Intel's provision of its test data back to the Plaintiff, especially in light of its own description of the exchange as a "project", amounts to a degree of cooperation between the two companies, which was considered as a factor by the English Patents Court in *Strix* (at 633–634) when finding the existence of an implied obligation of confidence.

85 In light of the foregoing reasons, I find that a reasonable man standing in Intel's shoes would have realised that the information was being given to him in confidence, much more Intel itself, which both sides described as being "paranoid" about preserving confidential information.[67] Much like in *Pall Corp* ([53] *supra*), the experimental nature of the samples, the conditions of confidence which appear to have been accepted by the recipient, and the

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65 NE Day 7, pp 62–63.

66 2ABA, p 914.

67 P's Closing Submissions, para 109.

unavailability of the samples to the public, all point towards the existence of an implied obligation of confidence. Given this finding, I add that there is no need for me to consider whether Intel and the Plaintiff shared a "special relationship", and whether such a relationship would legally suffice to show that no public disclosure was made (see [80] above).

86 For completeness, I observe that if the Plaintiff had signed a CDA or a JDA, the result would likely have been the same. An implied term of confidentiality such as to cover the experimental "IC-1000" pads could well have arisen. Whilst no submissions were made on applicable law, I note in passing that the well-known "officious bystander" test has been referred to in many cases in Singapore as a touchstone for the implication of terms (see *Sembcorp Marine Ltd v PPL Holdings Pte Ltd and another and another appeal* [2013] 4 SLR 193 at [91]). Indeed, in *Coco v Clark* (at 425), it is clear that if there were a contract, Megarry J would have found the officious bystander test to have been engaged. I say no more on this point.

(6) Whether the Sematech conference or the Plaintiff's dealings with Sematech amounted to prior disclosure

87 On 30 and 31 July 1991, a conference titled "Westech Chemical-Mechanical Planarization Users Group Meeting" ("the Sematech conference") was conducted under the auspices of Sematech. Sematech was a consortium set up in 1987 as a partnership between the US Government and a number of US-based semiconductor manufacturers.[68] Its objective at the time was to promote research and development in respect of manufacturing processes to restore competitiveness against non-US-based semiconductor manufacturers. One of the presentations at the Sematech conference was by Mr Louke of Intel and

[68] AEIC of Lee Cook, para 6.

titled "Defect Density Study – IC-60 vs. IC-1000 Pad" ("Mr Louke's presentation").[69] There were also other presentations by Sematech which mentioned the "IC-1000" pad and indicated that testing had been conducted on the "IC-1000" pads.

88 The Defendants seek to establish that these presentations at the Sematech conference amounted to or evidenced a prior disclosure of the "IC-1000" pads. The Plaintiff does not deny that Sematech had samples of the "IC-1000" pad as early as 12 April 1991, but takes the position that it had a confidential agreement with Sematech, and that Intel had given the Plaintiff permission to provide samples to Sematech.[70]

89 I adopt a similar analysis here to the one I adopted in respect of the alleged prior disclosure to Intel. In order to show an express obligation of confidence, the Plaintiff points to a "confidential information agreement" dated 27 March 1990 between the Plaintiff and Sematech ("the Sematech Agreement").[71] The Defendants however contend that it is unclear whether the Plaintiff followed the procedure designated in the Sematech Agreement, which included steps such as first seeking Sematech's agreement to receive the information in question and marking each page of information with the words "Confidential Information" or "Proprietary Information", in respect of the "IC-1000" pads. Regardless of whether any express confidentiality undertaking existed in respect of the "IC-1000" pads, I am of the view that there was an implied obligation of confidence. The Sematech Agreement envisioned the importance of confidentiality between the Plaintiff and Sematech. The

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69 4ABD, p 813.

70 NE Day 8, p 37.

71 5ABD, p 1070.

Sematech conference programme sheet was expressly marked "Confidential", and the slides of the conference presentations that were adduced into evidence did not appear to reveal information about the "IC-1000" pads that was of a confidential nature. The confidential nature of the conference is not surprising, given the purpose of Sematech.

90 Even if Sematech and the participants at the Sematech conference were not subject to obligations of confidentiality, and even if *some* information about the "IC-1000" pads was released at the Sematech conference, this does not necessarily mean that there was prior disclosure. Indeed, this depends on whether any information revealed during the presentations was sufficiently clear and complete such that a skilled addressee would have been able to develop the invention himself (*Mühlbauer* ([19] *supra*) at [17]). Mr Louke's slides only included some graphs, and summary bullet-points which very broadly stated some benefits of the "IC-1000" pad over the "IC-60" pad. The other presentation slides by Sematech which referenced "IC-1000" pads were equally if not more general. As such, it does not seem that there was any enabling disclosure, and I consequently find that the Patent was not anticipated by the disclosure of any information to Sematech or to others at the Sematech conference.

(7) Whether the Brochure amounted to commercial disclosure of the "IC-1000" pads

91 The Defendants led evidence from Mr Cadien, who stated that he was given the Brochure by an employee of the Plaintiff around May or June 1992.[72] The Brochure itself is dated December 1991. It briefly provides a description of "IC" pads in general, and sets out some physical properties of the "IC-40", "IC-

[72] NE Day 7, p 5.

60" and "IC-1000" pads such as their respective thickness and hardness.[73] According to Mr Cadien, the Brochure came with a small sample pad.[74]

92 The Plaintiff contests the provenance of the exhibited Brochure and indicates that there are visual differences between different copies of the Brochure that were tendered into evidence. The Plaintiff also argues that there are inconsistencies in the Defendants' case about the number of copies of the Brochure Mr Cadien had been given.[75] On the whole, however, I am inclined to believe Mr Cadien's evidence that he did in fact receive a copy of the Brochure with a miniature-sized sample pad sometime around May or June 1992.

93 That said, I still do not find that the Brochure amounted to commercial exposure of the "IC-1000" pads. I cannot surmise simply on the basis of the Brochure's existence that the "IC-1000" pad was commercially available before the Patent's priority date. Mr Cadien himself candidly admitted during cross-examination that he did not know whether the "IC-1000" pads had in fact been commercially available when he received the Brochure, and there was no other evidence indicating that they had been. Considering that the Brochure only describes "IC" pads in general terms and, for instance, does not mention what microelements are used in the pads, I also do not see how the Brochure alone can amount to prior disclosure of the "IC-1000" pads.

94 Moreover, since the Brochure is about "IC" pads in general, it is unclear whether the included sample is an "IC-40", "IC-60" or "IC-1000" pad. Even supposing that the sample is of an "IC-1000" pad, there is no evidence before

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73 4ABA, p 2366.

74 NE Day 7, pp 4–5.

75 P's Closing Submissions, paras 128–149.

me on what the sample would disclose to the hypothetical skilled reader. Once again, I see no enabling disclosure on these facts. Nor do I find the Brochure to contradict my earlier findings on the experimental nature of the "IC-1000" pads and the implied obligation of confidentiality owed by Intel to the Plaintiff.

95 In summary, I am satisfied that any disclosures with regard to the "IC-1000" pads and the Patent were made in confidential settings, which thus cannot be regarded as prior publications. In any event, any disclosure would not have been sufficient to enable the hypothetical skilled reader to make the invention. As the Defendants have not satisfactorily shown that Intel, Sematech or any member of the public was "free in law and equity to use" the information given to him, such information was not publicly available and did not form part of the state of the art. Accordingly, the Patent was not anticipated by any prior use of the "IC-1000" pads, and I dismiss the Defendants' challenge against the novelty of the Patent.

Inventive step

(1) The legal principles

96 I turn to the next requirement that the invention must involve an inventive step, as provided for in s 13(1)(*b*) of the Patents Act. Section 15 defines an inventive step as one that "is not obvious to a person skilled in the art", having regard to any matter which forms part of the state of the art by virtue only of matters made available to the public and without having regard to matters from patent applications with earlier priority dates but published later than the priority date of the invention.

97 In *First Currency Choice* ([47] *supra*) at [41], the Court of Appeal adopted the four-step test laid down by the English Court of Appeal in *Windsurfing International Inc v Tabur Marine (Great Britain) Ltd* [1985] RPC 59 ("*Windsurfing*") to determine whether an alleged invention involves an inventive step. The four steps in the *Windsurfing* test were applied and summarised as follows in *Mühlbauer* ([19] *supra*) at [20]:

> (a) Identify the inventive concept embodied in the patent in suit.
>
> (b) The court then assumes the mantle of the normally skilled but unimaginative addressee in the art at the priority date, imputing to him what was, at that date, common general knowledge in the art in question.
>
> (c) Identify what, if any, differences exist between the matter cited as being "known or used" and the alleged invention.
>
> (d) The court then asks itself the question whether, viewed without any knowledge of the alleged invention, those differences constitute steps which would have been obvious to the skilled man or whether they require any degree of invention.

98 As V K Rajah JA observed in *First Currency Choice* at [44], the first three steps of this test lay the ground work for the final critical question of *non-obviousness*: is the alleged invention obvious in the eyes of the notional skilled reader? I noted in *Lee Tat Cheng* ([25] *supra*) at [126] that whilst the court is often assisted in the assessment of obviousness by experts, the ultimate decision on non-obviousness is one of fact, impression and judgment, and one which only the court can make.

99 I note that unlike in the assessment of novelty, making a "mosaic" out of the prior art is permissible for the purposes of showing that an invention lacks an inventive step, as long as the mosaic can be put together by an unimaginative man with no inventive capacity (*Mühlbauer* at [93], citing *Technograph Printed Circuits Ltd v Mills & Rockley (Electronics) Ltd* [1972] RPC 346

("*Technograph*") at 355). The notional skilled person assesses the obviousness of an invention by reference to the whole of the state of the art relevant to the invention, including common general knowledge.

(2) The inventive concept of the Patent

100 The first step in the *Windsurfing* test is to identify the inventive concept embodied in the Patent. The Plaintiff submits that the inventive concept of the Patent is the use or incorporation of hollow, flexible, organic polymeric microelements in a CMP pad.[76] The Defendants instead describe the inventive concept as a polishing pad which combines the essential elements of (i) hollow, flexible, organic polymeric microelements; (ii) two layers of different hardness (a work surface and a subsurface); and (iii) the regeneration of the work surface when wearing down the pad.[77]

101 The parties' characterisations of the inventive concept of the Patent are not far apart. The difference is primarily in the level of detailing. The use of a plurality of hollow, flexible, organic polymeric microelements is essential to the regeneration of the subsurface as the new work surface. Rather than trying to split hairs between elements of the claim which are necessarily intertwined, I find the inventive concept to be the incorporation of hollow, flexible, organic polymeric microelements in the work surface and the subsurface, which allows for the regeneration of the work surface.

102 Identification of the inventive concept is closely related to interpretation of the patent specifications and the identification of the essential elements of the claimed invention. A patent is a property right. It is for the patentee to clearly

[76] P's Closing Submissions, para 158.

[77] Ds' Closing Submissions, para 260.

set out and define the subject-matter over which the property right is claimed (see s 25(5) of the Patents Act). The words and expressions used are the patentee's alone. It is by reference to the specifications that members of the public determine the boundaries of the claimed property right. The core task for the court is to determine how the skilled but unimaginative addressee would understand and interpret the words of the patent.

103 It is common for patents to embody numerous claims (see generally *Lee Tat Cheng* ([25] *supra*) at [103]–[105] and *Sun Electric Pte Ltd v Sunseap Group Pte Ltd and others* [2017] SGHC 232 at [185]–[190]). Each claim must be assessed on its own terms. By this, what is meant is that a claim may be valid even though other claims are found to be invalid because of want of novelty, inventive step or insufficiency, and so on. Each claim must, of course, be interpreted in the light of the patent specification and the claims as a whole. In many cases, the first few claims will set out the claimed invention in relatively broad terms. Subsequent claims will often employ tighter language or include other elements/integers. This may be done for the purposes of sharpening the focus or to narrow the essential elements/integers to make the claim more resistant to a validity attack. There may be other reasons as well. The key restriction on the number of claims is that the claims must relate to one invention or to a group of inventions (each claim being an invention) which are so linked as to form a single inventive concept (Patents Rules (Cap 221, R1, 2007 Rev Ed), r 25(1)). It is this "inventive concept" that is critical in the assessment of inventive step of the claimed invention.

104 In their closing submissions, the Defendants took issue with the Plaintiff's submission that the use of the said microelements in the pad has the "salutary effect of better planarization and lower defect polishing for the

substrate, as compared to earlier urethane pads without such microelements".[78] The Defendants argue that the Plaintiff's own expert, Prof Gutmann, admitted that the planarisation rate achieved by the invention was also achieved by the hollow glass microspheres in the "IC-60" pad used prior to the introduction of the "IC-1000" pad. The Defendants also point out that terms such as "low defect", "reduction in defects" and "defect density" are not mentioned anywhere in the Patent specification.

105 I begin by looking at the specifications of the Patent.

(a) Under the heading "Background of the Invention", the specifications state, "Conventional polymeric polishing pads often vary in quality due to imprecise control of polymerization and blending processes and cutting and shaping of the final pad product." The consequence is that the polishing characteristics would vary greatly between batches. As the top layer of a conventional polishing pad wears out and subsequent layers are exposed, the polishing properties of the pad vary, resulting in non-uniform polishing rates and producing inconsistent polishing characteristics on the surface of the work-piece.[79]

(b) The specifications explain that conventional polishing pads typically have textured surfaces. In conventional polishing pads, the microtexture is largely random due to the large number of variables in the manufacturing process.[80] Conventional polishing pads may include various solid particulates such as titanium oxide, glass dust and

78 Ds' Closing Submissions, paras 261–263.

79 The Patent, pp 1–2.

80 The Patent, p 3, lines 7–10.

diamond. Typically, the mixing and distribution of such particles is poorly controlled.[81]

(c) The specifications add that it is desirable to have: (a) a substrate for polishing and other operations in which the particle distribution of additives may be optimised on a molecular scale; (b) a polymeric substrate in which the surface regenerates itself and does not vary appreciably as the surface is contacted with the work-piece; and (c) a polishing substrate which has a series of hardness variations on a micro scale and which can be texturised on a mini or macro scale to help remove dross (effluent, grindings, *etc*) during polishing.[82]

(d) The Patent goes on to explain under the heading "Summary of the Invention" how the invention addresses the problems identified above.[83]

106 The "Abstract of the Disclosure" ("the Abstract") explains that:[84]

> [The article or polishing pad] includes a polymeric matrix impregnated with a plurality of polymeric microelements, each polymeric microelement having a void space therein. The article has a work surface and a subsurface proximate to the work surface. When the article is in contact with a working environment, polymeric microelements at the work surface of the article are less rigid than polymeric elements embedded in the subsurface. As the work surface of the article is abraded during use, the work surface of the pad may be continuously regenerated.

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81 The Patent, p 4, lines 1–3.

82 The Patent, p 4, lines 4–15.

83 The Patent, p 4, line 18 to p 7, line 18.

84 The Patent, p 33.

I pause to note that s 25(7) of the Patents Act states that the purpose of an abstract is to give technical information. The *CIPA Guide to the Patents Acts by the Chartered Institute of Patent Attorneys* (Paul Cole & Stephen Jones eds) (Sweet & Maxwell, 7th ed, 2011) at para 14.42 states that the purpose of the abstract is to provide an efficient instrument for the purposes of searching and disclosure in the particular technical field, in particular, by making it possible to assess whether there is a need to consult the specification itself. As such, the abstract does not assist in defining the extent of an invention. It does not qualify or supplant, but may at least provide a convenient albeit inconclusive "distillation" of the core points as set out in the summary of the invention in the specifications.

107 Nevertheless, I observe that the Abstract is consistent with the summary of the invention as set out in the body of the specification together with the drawings referred to and appended to the specification.[85]

108 For convenience, I set out Figures 1, 2, 3 and 11 together with a key based on the explanation set out in the specifications.

(a) Figure 1 is a schematic cross-sectional diagram of an article in accordance with the invention.

(b) Figure 2 is a schematic cross-sectional diagram of an alternative embodiment of an article according to the invention.

(c) Figure 3 is a schematic cross-sectional diagram of an alternative embodiment of an article according to the invention, in which

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[85] See the Patent, pp 4–7.

microelements at the work surface of the article have swelled when in contact with the working environment.

(d) Figure 11 is a schematic diagram of a device for pommelgating and puncturing a portion of shells of microelements at a work surface of an article according to the invention.

Legend / key to Figures 1, 2, 3 and 11

Feature no	**Feature, as described in the Patent**
10, 12, 110	Overall article or polishing pad
14	Polymeric matrix
15	Polymeric matrix at the work surface
16	Polymeric microelement
16’	Polymeric microelement at the work surface
18	Work surface
20	Permeable or puncturable shell of microelement
22	Void space within the microelement 16’ which will be rendered open when the microelement is punctured
24	Subsurface
30	Combined pommelgation and perforation device
32	Sharp implement or needle on the pommelgation-perforation device
34	Pad on the pommelgation-perforation device to prevent needles on the device from puncturing the work surface of the polishing pad too deeply

FIG. 1

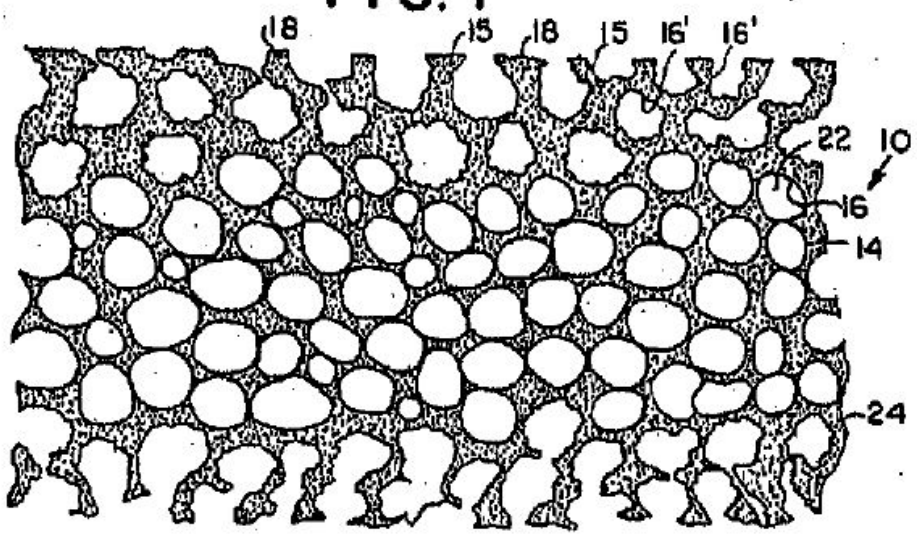
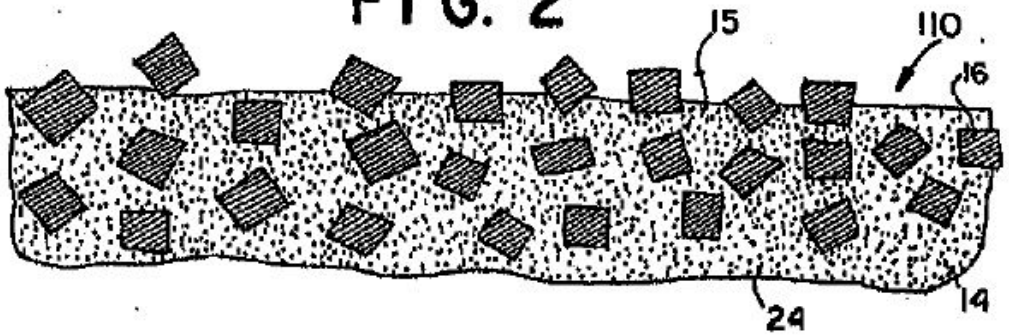


FIG. 2



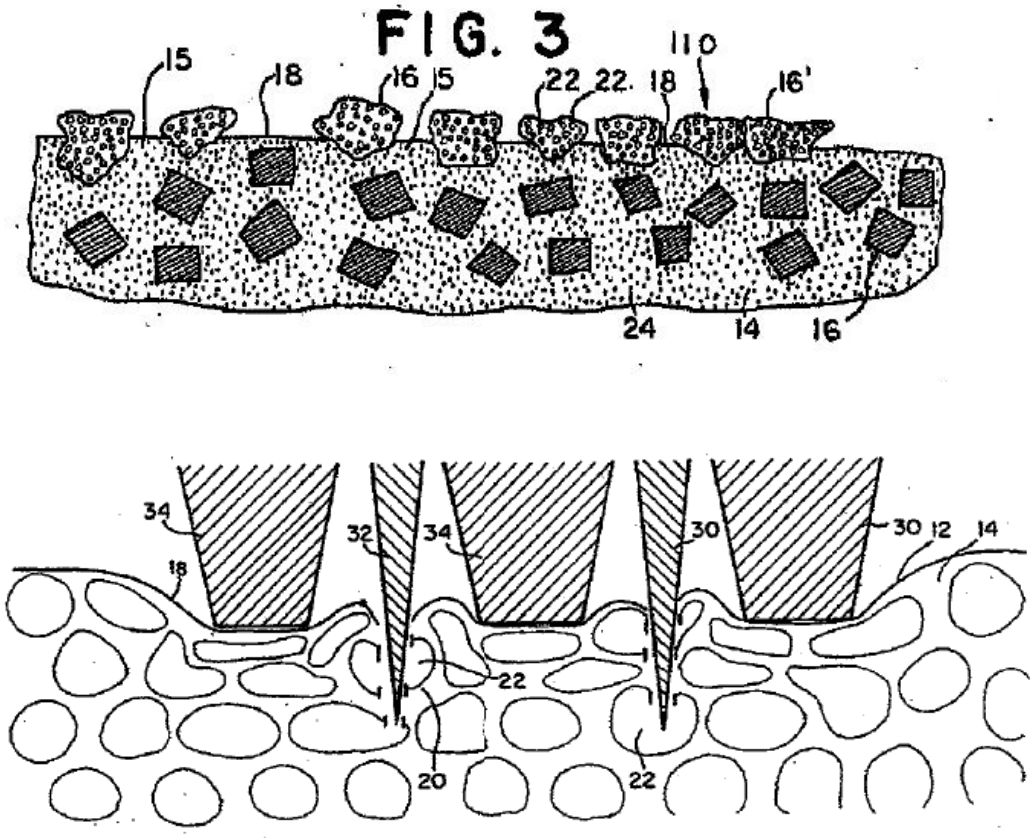


FIG. 11

109 The expert evidence is clear. As described earlier at [69]–[70], CMP pads had been used on many types of work-pieces including glass, and there were problems before the priority date over the use of conventional CMP pads on semiconductor wafers. The "IC-60" pad used glass microspheres which caused scratches on the wafers. Dr Moinpour agreed that the problem caused by scratches on the wafer would jump out to the skilled reader around 1990/1991 and that the glass beads were a contributory factor to the problem.[86] Mr Cadien described the problem as "a huge defect issue".[87]

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86 NE Day 10, pp 113–114.

110 Whilst the statement on the "Field of the Invention" set out at the start of the Patent's specifications explains that the invention can be used for polishing materials, it would not have escaped the notice of the skilled reader that the example provided was "semiconductor devices".[88]

111 Considering all of the above, I am satisfied that the inventive concept essentially lies in the use of hollow, flexible, organic, polymeric microelements in a CMP pad. This concept is essentially in claims 1 and 21. Claims 2 to 20 expressly relate back to claim 1 with the addition of specified points of detail and requirements such as the distribution, diameter, shape and permeability of the microelements (see claims 2, 8, 11 and 12 respectively). I note also that the only difference between claim 1 and claim 21 is a reference in the latter to a "texturized work surface".[89]

112 For completeness, I note that the Defendants raise arguments on claim construction based on the prosecution history. These will be touched on later in the analysis on the issue of infringement.

(3) The skilled addressee with common general knowledge in the art

113 The second step of the *Windsurfing* test is to impute the "common general knowledge in the art" at the priority date, to the "normally skilled but unimaginative addressee".

114 As observed by Rajah JA in *First Currency Choice* ([47] *supra*) at [28], the general rule is that he "should be taken to be the workman or technician who

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87 NE Day 7, p 69.

88 The Patent, p 1, lines 7–13.

89 The Patent, pp 28–32.

is aware of everything encompassed in the state of the art and who has the skill to make routine workshop developments, but not to exercise inventive ingenuity or think laterally". In a similar vein, Laddie J in *Pfizer Ltd's Patent* [2001] FSR 16 at [62] stated:

> … [The notional skilled reader] is a legal creation … He is deemed to have looked at and read publicly available documents and to know of public uses in the prior art. He understands all languages and dialects. He never misses the obvious nor stumbles on the inventive. He has no private idiosyncratic preferences or dislikes. He never thinks laterally. He differs from all real people in one or more of these characteristics. …

115 The notional skilled reader has been described as one of the most artificial legal constructs or personalities developed by law, alongside the reasonable man of tort law and the officious bystander of contract law (*Société Technique de Pulverisation Step v Emson Europe Ltd* [1993] RPC 513 ("*Société Technique*") at 519 *per* Hoffmann LJ; *Windsurfing* ([97] *supra*) at 71 *per* Oliver LJ). In *Société Technique*, Hoffmann LJ stated (at 519) that he was:

> … sceptical of the value of the varied cast of imaginary and sometimes improbable people, once described by Lord Radcliffe as "anthropomorphic conceptions" (*Davis Contractors Ltd. v. Foreham U.D.C.* [1956] A.C. 696, 728) which the law has invented to embody concepts like reasonableness, business efficacy, lack of inventiveness and even parental concern with children proposed for adoption. …

116 Hoffmann LJ stressed that it was important not to lose sight of the language of the relevant statutory provision: does the invention involve an "inventive step" as being "not obvious to a person skilled in the art"? This court agrees and adds that it is worth underscoring Hoffmann LJ's point that the words "obvious" and "inventive step" involve questions of degree that must be answered in accordance with the general policy of the Patents Act to reward and

encourage inventors without inhibiting improvements of existing technology by others.

117 Returning to the notional skilled reader, as stated in *Lee Tat Cheng* ([25] *supra*) at [30], he should fulfil the following criteria:

(a) possess common general knowledge of the subject matter in question;

(b) have a practical interest in the subject matter of the patent or be likely to act on the directions given in it; and

(c) whilst unimaginative, be reasonably intelligent and wish to make the directions of the patent work.

118 The parties appear to be generally in agreement that the skilled reader in this case is someone who has a degree in chemical, mechanical or materials engineering or in physics or chemistry, and with about three years' work experience with CMP processes. I also agree with the Plaintiff that the skilled person should be someone active in or otherwise *au fait* with CMP manufacturing around the priority date, or otherwise imputed with the common general knowledge in the art at the relevant time.

119 It was suggested by Prof Dornfeld and Dr Moinpour that a PhD qualification would more accurately reflect the range of knowledge that the skilled addressee should have. However, I agree with the Plaintiff that a person with a Bachelor's degree and the requisite experience can qualify as a skilled addressee. The notional skilled person does not need to be a CMP expert who researches and develops CMP processes. Whilst the level of skill required of the notional skilled person will depend on the subject matter of the patent in

question (*First Currency Choice* ([47] *supra*) at [28]), I see no particular reason in this context why the notional skilled person should have to hold an advanced degree.

(4) Differences between the state of the art and the invention, and obviousness

120 The third question asked in the *Windsurfing* test is how the inventive step goes beyond or differs from the state of the art, while the final question is whether these differences constitute steps which would have been obvious to the notional skilled person. I will discuss these two questions together in respect of the various pieces of prior art identified by the Defendants.

121 Before I turn to the various piece of prior art cited by the Defendants against inventive step, I set out some general points established by the case law on the assessment of inventive step.

(a) Obviousness is not a question of hindsight (*Mühlbauer* ([19] *supra*) at [101]); it is about the foresight of the notional skilled reader.

(b) "[T]he patentee is entitled to have the question of obviousness determined by reference to his claim and not to some vague paraphrase based upon the extent of his disclosure in the description" (*Conor Medsystems Inc v Angiotech Pharmaceuticals Inc* [2008] UKHL 49 ("*Conor Medsystems*") at [19]).

(c) The issue of obviousness must not be conflated with questions relating to sufficiency (*Conor Medsystems* at [17]).

(d) Whilst an oft-cited test or guide is to ask whether the skilled reader would have thought the patentee's solution well worth trying to

solve the problem (see generally *Johns-Manville Corporation's Patent* [1967] RPC 479), this test or guide must be applied with care. Not all inventions are solutions to problems that were known in the prior art. In some cases, the inventive step may reside in the elucidation/identification of the problem rather than the solution as such (see *David Kahn Incorporated v Conway Stewart & Company Limited* [1972] FSR 620 at 645). Not all inventions are solutions to problems in existing technology. The invention may be serendipitous or result from scientific breakthroughs which lead to the development of a radically new technology replacing the old or opening an entirely new field of industry. As Lord Hoffmann stated in *Conor Medsystems* at [42], a test for obviousness based on the idea of something being obvious to try is only useful in a case where there was a fair expectation of success. Indeed, Lord Hoffmann remarked at [28] that a test for obviousness based on whether it was obvious to try it *without any expectation of success* was an "oxymoronic concept" which had no precedent in the law of patents. To put it another way, if the prior art teaches many paths, one of which might lead to the solution, the obvious thing to do will be to try all of those paths. A decision to try a *particular* path, with no (fair) expectation that this path will in fact lead to success, is inventive.

(e) Evidence that the invention satisfied a long-felt need may indicate inventiveness (*Kang* ([25] *supra*), para 3.4.3); for if it were so obvious, why would it have taken so long for anyone to try the prior art suggestion? Commercial success may also provide some evidence of inventiveness at least where the success is due to the fulfilment of a long-felt need (*Hallen Co v Brabantia (UK) Ltd* [1991] RPC 195 at 208). That said, commercial success may not be conclusive or may be

irrelevant if the success was due to clever marketing (*Ng-Loy* ([58] *supra*) at para 30.1.60).

(f) Other factors, pithy guides and the like that have surfaced in past cases include whether the invention was "lying on the road" waiting to be picked up (*Merck* ([61] *supra*) at [62]), and whether the alleged inventive step overcame a prejudice in the prior art (*Pozzoli SpA v BDMO SA* [2007] EWCA Civ 588 at [27]).

122 Bearing the above points in mind, I turn to the prior art cited against inventive step. Considerably more prior documents and prior art uses were cited in the attack on inventive step (as opposed to novelty).

123 I start by noting that Prof Gutmann conceded during cross-examination that a number of elements of claims 1 and 21 of the Patent were taught by the prior art, but opined that these elements are "in various references which are rather disjointed from the point of view of different uses".[90]

124 The Defendants prepared a table setting out Prof Gutmann's views on the different elements of the claims, as elicited through cross-examination. I reproduce this table here:[91]

Claim Element	**Professor Gutmann's view elicited through cross examination**
1.1 (A polishing pad for polishing or planarizing a surface of an electronic substrate)	Element 1.1 disclosed in [the Japanese Patent], [the Brochure]

90 NE Day 5, pp 48–49.

91 Ds' Closing Submissions, para 253.

1.2 (said pad comprising)	NA
1.3 (a polymeric matrix impregnated with a plurality of hollow, flexible, organic polymeric microelements)	Reference to "balloon silicon dioxide" in [the Japanese Patent] teaches feature of "hollow microelement". Reference to "cross-linked polymer material such as epoxy resin" in [the Japanese Patent] teaches feature of "polymeric microelement", and would also be "often flexible" such that it would fall within line 23 of page 11 of the Patent (i.e. that at least a portion of the polymeric microelements are generally flexible). Reference to "epoxy resin" in [the Japanese Patent] teaches an "organic" microelement. Akzo Nobel "Introduction to Expancel Microspheres" dated April 1991 teaches the concepts of "hollow", "flexible", "organic" and "polymeric" microelements. He also agreed that all the cross linked polymeric materials listed at [page 232 of Volume 1 of the Defendants' Core Bundle] are "organic" save for silicon resin. Akzo Nobel Technical Bulletin No 22 teaches the concepts of "hollow", "flexible", "organic" and "polymeric" microelements. The [Robie Patent] teaches the concept of a hollow and flexible microelement.
1.4 (said pad having a work surface)	[The Japanese Patent] teaches the element of a "work surface".
1.5 (and a subsurface proximate to said work surface)	[The Japanese Patent] teaches the element of a "subsurface["]. He also agreed that any polishing pad must necessarily have a work surface and a subsurface.
1.6 (one portion of	[The Japanese Patent], read as a whole,

said polymeric microelements being at said work surface and exposed to a working environment including a polishing slurry)	would teach element 1.6, with the qualification that the microelements taught are not "hollow, flexible polymeric microelements".
1.7 (another portion of said polymeric microelements being embedded within said subsurface of said pad that is not exposed to said working environment)	[The Japanese Patent] teaches element 1.7, with the same qualification that the microelements taught are not "hollow, flexible polymeric microelements".
1.8 (said work surface of said pad is relatively softer than said subsurface as a result of said exposure of said one portion of said polymeric microelements at said work surface to said working environment, and[)]	He agreed that exposure to water would soften the polyurethane on the top surface of any polishing pad, and certainly the top layer of the pad would be softened.
1.9 (said subsurface becomes said relatively softer work surface during wear of said pad when said polymeric microelements are exposed to said working environment)	He agreed that element 1.9 is taught in the prior art.
21.4 (said pad having a texturized work surface)	He agreed that the prior art would have taught element 21.4.

[internal citations omitted]

(A) THE JAPANESE PATENT

125 According to the Defendants, the Japanese Patent is the closest prior art as it expressly or implicitly teaches all of the elements in claim 1 of the Patent, save that the various examples of microelements in the Japanese Patent do not individually disclose all the elements of being "flexible", "polymeric", "hollow" and "organic".[92] The Defendants argue that collectively, all of the elements are disclosed in the Japanese Patent. Given that the Japanese Patent is asserted as the closest prior art, I set out the Japanese Patent in some detail.

126 The title of the invention was "Polishing Pad".[93] The technical field states that "[t]he invention relates to a polishing pad for polishing semiconductor wafers with high precision and high efficiency, and metal contamination could be avoided".[94] The Japanese Patent describes certain problems with existing polishing pads and semiconductor products. In brief, these were as follows:[95]

> (a) Non-woven polishing pads filled with polyurethane resin achieved bad "planarization effect" because of the softness of the pad. During continuous polishing, the slurry and polishing rejects of the processed object would invade the successive pore structure of the pad. This would lead to solidification of the pad which could result in scratching.

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92 Ds' Closing Submissions, para 254.

93 PCBD, Tab 4, p 111.

94 PCBD, Tab 4, p 112.

95 PCBD, Tab 4, pp 112–113.

(b) Polymer/polyurethane foam polishing pads were widely used because they had "excellent abrasion [resistance]". These pads had a plurality of closed cell pores. The polishing slurry could not deeply invade the pads, such that the pads would not solidify during continuous polishing. The problem, however, was that degradation of the pad surface caused by the alkaline liquid and friction would occur earlier. Regular scraping of the pad surface was needed. This interrupted the polishing process and affected the flatness of the polishing pad.

127 The Japanese Patent goes on to describe the solutions to the problems. In brief, the solution was a polishing pad made of microelement-containing foaming polyurethane. The microelements were described as being less than 300μm and devoid of any element to influence the electric properties of a semiconductor.[96] The Japanese Patent also describes the composition of the foaming polyurethane, including the microelements. The microelements may be "*tiny fragments of a cured sheet* consisting of cross-linked polymer material such as epoxy resin, unsaturated polyester resin, melamine resin, silicon resin, etc. In addition, regarding the high purity synthetic silicon dioxide material, *balloon silicon dioxide*, fumed silicon dioxide, etc. may be used" [emphasis added].[97] The Japanese Patent explains that the surface of the polishing pad is slightly scraped during polishing to regenerate the surface of the polishing pad.[98]

128 Although I do not consider the objective of the Patent as stated in the specification to be "decidedly different" from the motive of the Japanese Patent (to reduce interruptions to the polishing process by reducing the number of

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96 PBCD, Tab 4, p 113.

97 PBCD, Tab 4, p 114.

98 PBCD, Tab 4, p 116.

scrapings to the surface of the pad)[99] as the Plaintiff posits,[100] I agree with the Plaintiff that there are appreciable differences between the Patent and the Japanese Patent.

129 As the Defendants concede, the most notable of these differences is that none of the examples of microelements mentioned in the Japanese Patent have all of the features of a "flexible", "polymeric", "hollow" and "organic" microelement. The Japanese Patent states that the microelements are composed of either cross-linked polymer material or inorganic silicon compound material.[101] In particular, it states further that microelements may be tiny fragments of a cured sheet consisting of cross-linked polymer material, but this does not convey properties such as hollowness and flexibility. The alternative of balloon silicon dioxide is not flexible, organic or polymeric, whereas the alternative of fumed silicon dioxide does not appear to satisfy the four aforementioned features.[102]

130 I agree with the Plaintiff that the reference to the pad's "low compressibility" in the Japanese Patent does not refer to the bulk of the pad when considered in context. The Japanese Patent states that the low compressibility provides a better flatness or planarisation of the work-piece, which indicates that this description relates to the microelements.[103] As the Plaintiff argues, this does not suggest flexibility in the microelements used.

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99 PCBD, Tab 4, p 117.

100 P's Closing Submissions, para 217.

101 PCBD, Tab 4, p 111.

102 P's Closing Submissions, paras 224–225.

103 PCBD, Tab 4, p 116.

131 Moreover, while the Japanese Patent names several examples of microelements that may be used, it does not clearly mention any of the four said properties of the microelements used in the Patent. In describing the "[s]olutions [to] the problems", the Japanese Patent only mentions that the microelements are less than 300μm in size and devoid of any element to negatively influence the electric properties of a semiconductor.[104] Further, Prof Gutmann testified that it was scientifically impossible to combine balloon silicon dioxide and cross-linked polymer material to form a hollow, flexible, organic polymeric microelement.[105] Indeed, the Plaintiff submits that this material can fracture into glass shards during the CMP process, resulting in scratches to the wafer.[106]

132 The Japanese Patent does not reference the working environment. I am also unable to see how the Japanese Patent implicitly discloses that the pad's surface is relatively softer than the subsurface as a result of the exposure of microelements to the working environment.

133 It will be recalled that the Japanese Patent (published in 1990) was owned by Rodel Nitta Company, a joint venture between the Plaintiff and Nitta Corporation of Japan (see [15(b)(i)] above). At that time, the personal computer market was developing rapidly on the back of developments in both semiconductor design and fabrication as well as software. The competition between the US computer industry and the Japan computer industry was a major reason for the setting up of Sematech.[107] Whilst there is no evidence on the details of the relationship between the Plaintiff and Nitta Corporation, the

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104 PCBD, Tab 4, p 113.

105 P's Closing Submissions, para 228.

106 Plaintiff's submissions at para 224; NE Day 10, p 113, lines 1–25.

107 NE Day 7, p 65.

skilled reader would be aware that the semiconductor design and fabrication industry was highly competitive and that the demand for semiconductor products was rapidly increasing. It comes as no surprise that manufacturers of technology used in the semiconductor fabrication industry would be active in developing new products for use by chip manufacturers. The problems arising from the use of conventional CMP pads on wafers, such as scratching and lack of consistency due to pad degradation, were known.

134 Different approaches in the search for a "better" CMP pad for polishing wafers could be tried. The invention embodied in the Japanese Patent was in the same general technical field as the Plaintiff's "IC-1000" pad. The solution reached was not the same. The emphasis in the Japanese Patent was on the degradation of the surface of the pad arising from contact with alkaline liquid and friction (see [126(b)] above). The need for regular scraping of the pad to regenerate the surface was also underscored in the Japanese Patent (see [127] above).

135 In contrast, the Patent states that the polymeric microelements at the work surface are less rigid, while those in the subsurface of the pad are more rigid (see [5] above). The Patent further states that the hollow microelements have puncturable or permeable shells so that the void spaces within can be rendered open to the working environment as shown in Figure 11 (shown at [108] above). I have no doubt that the skilled reader will understand that this is the means by which a softer or less rigid work surface is achieved (see [166] below). The Patent explains that as the work surface of the pad wears, the subsurface immediately below becomes the new work surface. In this way, two levels of hardness are maintained and regenerated continuously.[108]

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[108] The Patent, p 15, lines 5–11, p 24, line 27 – p 25, line 5.

136 Taking all these differences into account, as well as what is mentioned (and not mentioned) in the specification of the Japanese Patent and bearing in mind the applicable legal principles on inventive step, I find that the inventive concept would not have been obvious to the skilled person on the basis of the Japanese Patent alone.

137 I will later consider whether the Japanese Patent can be mosaicked with the other pieces of prior art such as the Akzo Nobel Publications, such that it would have been obvious for the skilled reader to try to incorporate "Expancel" microspheres into a polishing pad.

(B) THE ROBIE PATENT

138 The Robie Patent is a process patent which generally aims to improve the cutting of a grinding wheel in various ways. The specification states that the "invention may be applied using … the balloon-like particles or granules of any of the brittle rigid sponge-like materials in any type of abrasive body in which … the bond is organic". I note that the Robie Patent relates to abrasive materials and does not mention CMP pads.[109]

139 Indeed, the Defendants' experts agreed that the Robie Patent does not disclose that the abrasive bodies are suitable for polishing electronic substrates.[110] Instead, the Defendants rely on it only in conjunction with the Japanese Patent. The Defendants' case is that it would have been obvious to the skilled person to combine the invention in the Japanese Patent with the concept of using thin-walled balloon-like or sponge-like bodies as disclosed in the Robie Patent, if the skilled person was looking for an alternative to the usual brittle

109 PCBD, Tab 2.

110 AEIC of Prof Dornfeld dated 24 October 2014, p 493; NE Day 9, p 136.

and rigid abrasives in order to solve the scratching problem caused by the "IC-60" pad.[111]

140 While I accept that the alternative of using balloon-like particles may disclose or suggest the concept of using hollow organic microelements, it is not clear to me that the Robie Patent teaches the concept of using microelements that are hollow, *flexible* and polymeric. The alternative of "*particles* or *granules* of any of the *brittle rigid* sponge-like materials" [emphasis added] does not, on the whole, suggest the quality of flexibility. Indeed, Dr Moinpour testified that the Robie Patent teaches abrasive bodies used for grinding wheels,[112] and also agreed that "coarse grinding would not necessarily be something that you want to try on your delicate wafers".[113]

141 Even when mosaicked with the Japanese Patent, I do not see how the unimaginative skilled reader would infer from the Robie Patent all of the four said qualities of the microelements used in the Plaintiff's Patent, let alone think of using the microelements that were in fact described and used in the Patent. In any event, it appears to me that some degree of inventiveness beyond what the notional skilled person possesses would be required to mosaic the relevant parts of the Japanese Patent and the Robie Patent together in the first place.

(C) THE AKZO NOBEL PUBLICATIONS

142 As mentioned at [15(b)(iii)] above, the Akzo Nobel Publications are three bulletins dated January 1989, April 1991 and October 1991) which concern a type of microsphere known under the trade mark "Expancel". The

111 Ds' Closing Submissions, para 280.

112 NE Day 9, p 136.

113 NE Day 10, p 122.

Akzo Nobel Publications generally describe the properties, uses and advantages of "Expancel" microspheres, without referring to CMP or any application in the field of semiconductors.

(a) The January 1989 Bulletin, whilst titled "Technical Bulletin", appears to be a form of product information sheet for potential customers. It is not a scientific or industrial research paper. "Expancel" is described as microcellular foam which could, for example, be used in the manufacture of shoe soles, with the advantage of reduced density and lower material costs. The January 1989 Bulletin also discloses that "Expancel" microspheres are elastic and able to withstand hard mechanical crushing.[114]

(b) The October 1991 Bulletin and the Akzo Nobel Article are similar to the January 1989 Bulletin, with slightly more technical detail provided. Reference is made to the ability of "Expancel" to work as a shock absorber. The Bulletin states that unexpanded "Expancel" can be used as a blowing agent for printing ink, paper and board, non-woven mats, the soles of jogging and leisure shoes, and polyvinylchloride-plastisols.[115] Other uses mentioned include as auto body fillers, marine and hobby putty, rubber compounds (for compressibility), car underbody coatings, cable fillings and explosives.

143 Again, the Defendants do not appear to argue that the Akzo Nobel Publications on their own render the invention in the Patent obvious, but that mosaicking the Japanese Patent and the Akzo Nobel Publications together, it

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114 PCBD, Tab 5, pp 118–119.

115 PCBD, Tab 6, p 125.

would have been obvious for the skilled reader to incorporate the ready-made "Expancel" microelements into the existing "IC-60" pads.

144 The Defendants mainly rely on Prof Gutmann's concessions during cross-examination that the skilled reader would be "encouraged" to try "Expancel" as an alternative to the "Q-Cel" glass microspheres.[116] Yet, I note that Prof Gutmann also stated during cross-examination that he firmly believed that in 1992, it would not have been obvious for the skilled person to try incorporating "Expancel" into the "IC-60" pads.[117] Prof Gutmann's reason for this was that there was nothing in terms of the material available on "Expancel" such as the Akzo Nobel Publications which indicated any use in the area of electronics and semiconductors. Even though "Expancel" microspheres were known to have uses in polyurethane systems, the Akzo Nobel Article only listed "jogging and leisure shoes" as an example of a commercial application.[118]

145 Even though the skilled reader is assumed to have had access to the prior art as a whole, it is well-established that not all disclosures in the prior art will enjoy the same weight (*Inhale Therapeutic Systems Inc v Quadrant Healthcare Plc* [2002] RPC 21 ("*Inhale*") at [47]). An assessment of inventive step is necessarily judgmental. The skilled reader, even though he is unimaginative, does have the ability to evaluate and assess the relevance and weight of the disclosures. Factors include how distant and unrelated the prior art's field of research is, and whether the prior art is directed at solving the particular problem at issue (*Inhale* at [47]).

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116 NE Day 5, p 62.

117 NE Day 4, p 25.

118 PCBD, Tab 6, p 125.

146 For example, in *Imperial Chemical Industries Ltd (Pointer's) Application* [1977] FSR 434, the invention in question related to the problem of degradation and oxidation of the plastic insulators on jelly-filled electrical cables (at 448). Existing antioxidants were affected by substances used in the manufacturing process of electrical wires. The prior art included a commercial brochure (described as a technical bulletin) which described a substance, Compound X, that was used to stabilise plastics from degradation by light. The brochure also referenced the fact that Compound X also possessed antioxidant properties by way of comparison to some other known antioxidants, one of which was thought to be superior. The inventor discovered that Compound X was an excellent antioxidant for the electrical cables. The Patents Appeal Tribunal found (at 455) that the reference to the use of Compound X as an antioxidant in the prior art was incidental and that the brochure was essentially extolling the use of Compound X as a light stabiliser, *ie*, for use in a different field of industry. After giving the brochure the appropriate weight, it was held (at 456) that the skilled addressee would not have thought it obvious on the basis of the said brochure to try Compound X as an antioxidant for jelly-filled electrical cables.

147 In the case at hand, no prior art explains how exactly "Expancel" microspheres can be incorporated into a CMP pad. There is ample evidence that manufacturing the pads as presented in the Patent is a matter of some precision in respect of factors such as temperature, timing, density and quantity of the microelements, choice of polymer matrix and the use of high-shear blending. Mr McClain's laboratory notebook also revealed that his team had conducted substantial experimentation, such as with different densities of "Expancel" microspheres, before producing the four prototype pads that were sent to Intel (see [70]–[71] above). While not determinative in itself, this does in my view

lend support to the finding that the prior art raised by the Defendants thus far does not render the invention in the Patent obvious to the skilled person. Further, whilst the Akzo Nobel Publications refer to a range of potential uses such as for soles of running shoes, car body filler, shock absorber and rubber compounds, there is nothing to suggest that "Expancel" was being put forward for use in CMP pads or semiconductor products. The brief passing reference to use in rubber compounds and compressibility is precisely that: a passing reference.

(D) OTHER PRIOR ART

148 I will deal briefly with the other prior art mentioned by the Defendants in their submissions:

(a) The Brochure: As I observed at [93] above, the Brochure only describes "IC" pads in general terms, and does not mention what microelements are used in the pads or describe their characteristics.

(b) The Mattingly Patent: The invention in the Mattingly Patent is "[a]n improved method for conditioning the surface of a pad". It is not concerned with the composition of a CMP pad, and does not disclose the type of polymeric microelements used in the Patent.[119]

(c) The Ashby article: The article discusses the properties of foams and cellular solids. Part of the article describes the flexibility of polymeric foam cells under loading. However, it does not disclose or relate to any of the elements of the Patent.[120]

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119 1DCBD, Tab 11, p 256.

120 1DCBD, Tab 4.

149 Even if all the above items are considered "prior art" that has been made available to the public, I do not find them to be any more than tangentially relevant to the Patent, let alone able to allow the notional skilled reader to come up with the invention therein.

150 Finally, for completeness, I add that even if the skilled reader had all the prior art disclosures cited against inventive step before him, there is no obvious mosaic that would lead to the invention as claimed. Looking at the evidence, I also find that the skilled person would not have found it obvious to adapt the cross-linked polymer material disclosed in the Japanese Patent so as to take the form of micro-balloons (hollow, flexible and polymeric), instead of tiny fragments of a cured sheet, in order to reduce scratching and surface defects of the work-piece.

151 The Defendants challenge the lack of inventiveness in respect of the entire Patent, not just claim 1, which has largely been the subject of the foregoing analysis. Although most of the other claims in the Patent are dependent upon claim 1, just as I remarked in *Lee Tat Cheng* ([25] *supra*) at [104] in the context of the analysis on novelty, it should again be borne in mind that subsequent claims do not *ipso facto* stand or fall on the independent claim. That said, in this case it was clear that the inventive concept (as identified at [101] above), which was stated in claim 1 (as well as claim 21), extended to the other claims that were dependent on claim 1.

152 Having examined all the relevant prior art and considered the parties' arguments, I find that the invention in the Patent would not have been obvious to the skilled reader in 1992.

Sufficiency

(1) The legal principles

153 Apart from the requirements for a "patentable invention" under s 13(1) of the Patents Act, s 80(1)(*c*) also provides that a patent may be revoked if its specification "does not disclose the invention clearly and completely for it to be performed by a person skilled in the art", *ie*, the notional skilled reader.

154 The skilled reader, as the addressee of the patent specifications, plays a vital role in patent law. In the first place, the question as to what is the "claimed invention" is answered from his perspective. Second, it will be recalled that in the case of novelty, the inquiry is whether the skilled reader would find that the claimed invention was anticipated by items in the prior art (see [48] above). Third, in the case of inventive step, would the skilled addressee find the claimed invention obvious in light of the prior art (see [113]–[117] above)? Whilst the characteristics of the skilled addressee are the same in each inquiry, the questions to be determined are "obviously" different.

155 In the case of sufficiency and enabling disclosure which I now turn to, the question is whether the skilled reader would be able to perform the claimed invention (see [153] above). A two-step test was set out by Lord Hoffman in *Kirin-Amgen Inc v Hoechst Marion Roussel Ltd* [2005] RPC 9 ("*Kirin-Amgen*") at [103] to determine whether the specification of a patent is sufficient:

> … The first step is to identify the invention and decide what it claims to enable the skilled man to do. Then one can ask whether the specification enables him to do it.

156 The Court of Appeal in *First Currency Choice* ([47] *supra*) (at [62]) adopted Lord Hoffman's two-step test and supplemented it with two further considerations:

> First, the specification of the patent must embrace an embodiment of the invention asserted in each of the claims with sufficient particularity to enable the invention to be understood and carried into effect by those in the industry without making further inventions or prolonged study of the matter. The specification must be set out clearly and fairly so that any individual desirous of carrying out the invention may obtain full knowledge of its practical aspects. But, it is not necessary that the specification be so detailed that this notional individual can perform the invention without any trial or experiment at all. Second, the description of the invention should not be unnecessarily difficult to follow, and must not contain any traps or seriously misleading statements which the reader cannot correct.
>
> [internal citations omitted]

157 In other words, while the patent specification must be "clear and complete", it "need not set out every detail necessary for the performance of the invention, but can leave the skilled man to use his skill to perform the invention" (*First Currency Choice* at [59] and [60]). The sufficiency requirement is met if the skilled person can carry into effect or work the invention without making further inventions or engaging in a prolonged study of the matter; this is so even if the skilled person has to engage in some trial or experiment in the process of working the invention (*First Currency Choice* at [62]). If there was a requirement that specifications had to set out a step-by-step mechanical guide for all the uses falling within the scope of the claimed invention, the patent specifications would likely run into innumerable paragraphs.

158 Susanna H S Leong, *Intellectual Property Law of Singapore* (Academy Publishing, 2013) ("*Susanna Leong*") at para 16.271 cites *Martek Biosciences Corp v Cargill International Trading Pte Ltd* [2011] 4 SLR 429 ("*Martek*")

generally for the proposition that it is not enough for the party challenging sufficiency to merely highlight ambiguities in the plain language of the claims (see *Martek* at [35]). Instead, the burden of proof is on the said party "to show that those ambiguities would render the invention unworkable from the point of view of a person skilled in the art who is trying to give practical meaning to the patent specification" (*Susanna Leong* at para 16.271). The learned author goes on (at paras 16.272, 16.282 and 16.285) to identify three main categories of insufficiency: (a) the specification does not disclose what is claimed; (b) the specification does not disclose all that is claimed; and (c) the specification claims more than what is disclosed. Whilst this classification is helpful, the core principle is the same: do the specifications enable the skilled reader to perform the invention as set out in the claim(s) in question?

159 If the inventive concept discloses a principle of general application, the claims may use words of similarly general application subject to the condition that the inventive concept must be reasonably expected to work for anything that falls within the claims (*Susanna Leong* at para 16.291). In other words, if an element of a claim is stated in general terms, the claim "is sufficiently enabled if one can reasonably expect the invention to work with anything which falls within the general term" (*Kirin-Amgen* at [112]–[113] *per* Lord Hoffmann). It follows that where the specifications disclose an invention which embodies a core principle of general application or which may be carried into effect in a variety of ways (*eg*, for different specific uses such as polishing metal or wafers), the patentee generally need not set out the details for all such possible instances. The fact that the skilled reader is unimaginative does not mean that he does not possess workshop skills or that he is an automaton who is only able to blindly follow instructions. After all, the skilled reader possesses

common general knowledge and common sense as befits the area of technology in question (see [114] and [117] above in the context of inventive step).

160 Ultimately, the question of the sufficiency of the disclosure in each case is a matter of fact that depends on the nature of the invention and the other circumstances of the case (*Genelabs* (CA) ([60] *supra*) at [60]).

161 Failure to comply is a ground for revocation and invalidity (s 80(1)(*c*) of the Patents Act). Enabling disclosure is a fundamental requirement because it lies at the heart of the bargain between the inventor/patentee and society. In return for disclosing sufficiently to enable a skilled reader to work the claimed invention, the inventor is provided with a limited term of patent protection – a full property right enforceable *in rem* on a strict liability basis. If a skilled reader finds that he must engage in inventive or prolonged work or experiments to perform the claimed invention, the premise for the bargain fails.

162 It is with these points in mind that I turn to the specifications of the Patent at hand.

(2) Whether the Patent meets the requirements of sufficiency

163 I start with some general observations about the Patent. Given that this area involves semiconductor wafers and related processes, any patent specification will reasonably require a higher degree of precision. During trial, the process of manufacturing CMP pads was analogised to that of baking a cake. For example, when making "IC-60" pads, the pre-polymer, curative and filler material would be mixed together in a specialised machine, brought to a specific temperature, blended together, poured into a mould, and placed into a curing oven, where it was made to "cure" or rise like a cake.[121] And much like cake-

baking, precision in factors such as temperature, time and ingredients is essential. It was apparent to me that the Patent went into detail regarding these factors when describing the manufacture of the invention, and set out six examples illustrating how the invention could be prepared using different polymer matrices and constituents.[122] The Defendants do not dispute the sufficiency of these factors, but raise four specific contentions which I will address in turn.[123]

164 First, the Defendants submit that the expressions "work surface" and "subsurface" are not precisely defined in terms of size, shape or location. However, it is unclear to me why the skilled person would require a further explanation of these terms, or why he would need to know the exact shape or location beyond what is described in the Patent or understandable from the context of the very terms themselves. In any event, the Patent does explicitly state, with reference to diagrams, that a preferred embodiment of the invention is as follows:[124]

> The article 10 has a work surface 18 and a subsurface 24 proximate to the work surface 18, as best shown in Figs. 1-3. Preferably, the work surface 18 is about 5 μm to about 60 μm thick. The thickness of the article 10 is preferably between about 300 μm and about 400 μm in a direction generally perpendicular to a major plane (not shown) of the work surface 18.

Further, Prof Dornfeld himself recognised that "one cannot define exactly a 'work surface' [or subsurface] with specific size, shape or location" as the exact contact area in the surface region of the pad will vary during polishing.[125] Given

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121 NE Day 1, pp 38–39. See also 1DCBD, p 39.

122 1DCBD, pp 92–96.

123 Ds' Closing Submissions, paras 289–298.

124 1DCBD, p 59.

the above reasons, I am unable to see how the Patent could have defined the size, shape, location and concept of the "work surface" and "subsurface" with significantly more clarity, or why it should have done so.

165 Secondly, the Defendants contend that the Patent does not teach how the relative hardness and softness of the work surface and subsurface may be reliably measured. I agree with the Plaintiff's counter-argument that the skilled person does not require a method of measurement of the hardness or softness of the work surface and subsurface in order to make the invention in the Patent.[126] He only needs to be concerned with whether the microelements at the work surface open upon exposure to the working environment, which would make the work surface softer than the subsurface containing the closed microelements. Indeed, Dr Moinpour took the view that the Japanese Patent had implicitly disclosed the relative softness of the work surface to the subsurface upon exposure to the working environment, even though the Japanese Patent also did not provide a method for measuring hardness.[127] The Patent's silence as to the method of measuring the hardness of the respective surfaces does not constitute a reason for finding that the requirement of sufficiency has not been satisfied.

166 On a related note, the Defendants argue that the Patent does not teach how one may ascertain whether the relative softness of the work surface to the subsurface was caused by exposure of microelements at the work surface to the working environment. To this, the Plaintiff cites Dr Moinpour's own expert report for the Defendants, which states that "[l]ogically, any work surface

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125 1ABA, p 310.

126 P's Closing Submissions, para 313.

127 NE Day 10, pp 98–99.

containing microelements that have been punctured will be relatively softer than a subsurface with no punctured microelements simply by virtue of the puncturing of the microelements at the work surface".[128] It does appear to me that the skilled person would know that contact between the work surface and the work-piece during polishing would open up or puncture the hollow microelements at the work surface. As Dr Moinpour concedes, the skilled person would also know that the opening up of microelements and release of pressure would make the work surface softer relative to the unexposed subsurface below. The Patent therefore does not lack an explanation with regard to the softening of the work surface that would not already be within the common general knowledge of the notional skilled person.

167 Finally, the Defendants contend that the expression "flexible", which is used to describe the polymeric microelements used, is not precisely defined in the Patent. Again, I see no particular reason why an absolute definition or measurement of "flexibility" is required for the skilled person to make the invention, especially considering that the examples listed in the Patent already disclose the use of "Expancel" microspheres.

168 In reaching my decision on sufficiency, I note that the general concept of using CMP pads for polishing a variety of different types of work-pieces was well-known at the time of the invention. Whilst the Plaintiff's invention was motivated by the desire to find a better CMP pad for semiconductor wafers, it is apparent that the inventive concept and claims are not limited as such to the polishing of semiconductor wafers. This is readily apparent from the description of the background of the invention, the summary of the invention and the description of the preferred embodiments (see [105] above).

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128 P's Closing Submissions, para 314.

169 Some of the elements in the description are indeed couched in broad terms. For example, the description of preferred embodiments states that the pad, whilst generally circular, can also be square, rectangular or any shape as desired. This was something the Patent asserts would be understood by any person with ordinary skill in the art.[129] The description explains that different slurries can be used – all well-known to those skilled in the art.[130] The choice of slurry, *etc*, would depend on the nature of the work-piece. To use a simpler analogy, a new type of material developed for use as a polishing cloth may be used to polish many types of objects made from a variety of materials. The size, shape and thickness of the cloth and the type of polish that should be used (if any) will depend on the nature of the article and the material from which it is made. Whilst this is just a hypothetical, and bearing in mind that all the circumstances must be considered, the skilled reader armed with common knowledge is unlikely to need to expend inventive effort or prolonged testing to work the invention if a general disclosure is made of the invention and how to work the inventive concept (see [159] above).

170 In any event, in respect of the matters of which the Defendants make complaint as being insufficient, vague and imprecise, *ie*, work surface, subsurface, relative hardness or softness and flexibility, I find that the objection has not been established on the evidence and a reading of the specifications and claims.

171 Without going into the question of whether this court possesses original jurisdiction to revoke a patent, I find here that the Patent does fulfil the

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129 The Patent, p 9, lines 12–17.

130 The Patent, p 9, lines 27–30.

requirement of sufficiency such that revocation would not be warranted in any event.

172 Given my above analysis, there are no grounds upon which the Patent should be invalidated or revoked. I therefore find the Patent to be valid, and dismiss the Defendants' prayers for a declaration of invalidity and an order for revocation.

Infringement

173 Even if the Patent is found valid, the Defendants' case is that their actions did not infringe the Patent.

174 Section 66(1) of the Patents Act states:

> Subject to the provisions of this Act, a person infringes a patent for an invention if, but only if, while the patent is in force, he does any of the following things in Singapore in relation to the invention without the consent of the proprietor of the patent:
>
> > (*a*) where the invention is a product, he makes, disposes of, offers to dispose of, uses or imports the product or keeps it whether for disposal or otherwise …

Whether new, as-received and unconditioned pads can fall within the asserted claims

175 The Defendants' primary submission is that the NexPlanar pads they dealt with were new, as-received and unconditioned pads which do not fall within the scope of the asserted claims, which only cover conditioned or "broken-in" pads. I will deal with this argument first.

The legal principles on claim construction

176 This is essentially a question of claim construction. I begin with the oft-cited comments in *Catnic Components Limited v Hill & Smith Limited* [1982] RPC 183 ("*Catnic*") at 242–243:

> [A] patent specification is a unilateral statement by the patentee, in words of his own choosing, addressed to those likely to have a practical interest in the subject matter of his invention (i.e. "skilled in the art"), by which he informs them what he claims to be the essential features of the new product or process for which the letters patent grant him a monopoly.

The task is to ascertain what the patentee's words conveyed to the notional skilled reader (see *Mühlbauer* ([19] *supra*) at [25]).

177 In ascertaining the scope of the claimed invention, the claims themselves are the *principal* determinant, while the description and other parts of the specification may *assist* in the construction of the claims (*First Currency Choice* ([47] *supra*) at [23]). Words used in the claims may be affected or defined by what is said in the body of the patent specification (s 113(1) of the Patents Act). Claims should not be viewed independently but should instead be construed as part of the whole specification (*First Currency Choice* at [24]). It is not, however, permissible to put a gloss on the meaning or to expand the claims by relying on statements in the specification where the meaning of the words used in the claim are clear and unambiguous (*First Currency Choice* at [24]). By this, what is meant is that if the claims have a plain meaning, reliance should not be placed on the language used in the body of the specification to make the claim mean something different.

178 The claims should be purposively interpreted: the interpretation must be "highly sensitive to the context of, and background to, the particular utterance"

(*Kirin-Amgen* ([155] *supra*) at [32]), rather than a literal interpretation derived from "meticulous verbal analysis" (*Catnic* at 243). I reiterate that the threshold question for the court to ask is what the notional skilled person would have understood the patentee to mean by the use of the language of the claims (*Mühlbauer* at [25]).

179 To infringe the Patent, the Defendants must take all the "essential integers" or elements of the claimed invention (see *Rodi & Wienenberger AG v Henry Showell Ltd* [1969] RPC 367 at 391, cited with approval in *First Currency* at [77]). This can be contrasted with copyright where infringement arises if there has been a *substantial* taking from the work (Copyright Act (Cap 63, 2006 Rev Ed), s 10).

Some observations on the Catnic/Improver *approach to claim construction and the impact of* Eli Lilly

180 Patent law has long tussled over how the courts should approach a variant in an alleged infringement which may or may not have a material effect upon the function of the invention. This is important in cases where a defendant's alleged infringement substitutes an element with something which performs the same function. The following paragraphs from *Catnic* at 243 set out Lord Diplock's approach to purposive claim construction:

> The question in each case is: whether [the skilled person] would understand that strict compliance with a particular descriptive word or phrase appearing in a claim was intended by the patentee to be an essential requirement of the invention so that *any* variant would fall outside the monopoly claimed, even though it could have no effect upon the way the invention worked.
>
> The question, of course, does not arise where the variant would in fact have a material effect upon the way the invention worked. Nor does it arise unless at the date of publication of the specification it would be obvious to the informed reader that

> this was so. Where it is not obvious, in the light of then-existing knowledge, the reader is entitled to assume that the patentee thought at the time of the specification that he had good reason for limiting his monopoly so strictly and had intended to do so, even though subsequent work by him or others in the field of the invention might show the limitation to have been unnecessary. It is to be answered in the negative only when it would be apparent to any reader skilled in the art that a particular descriptive word or phrase used in a claim cannot have been intended by a patentee, who was also skilled in the art, to exclude minor variants which, to the knowledge of both him and the readers to whom the patent was addressed, could have no material effect upon the way in which the invention worked.
>
> [emphasis in original]

181 Subsequently, Hoffmann J in *Improver Corporation v Remington Consumer Products Limited* [1990] FSR 181 ("*Improver*") (at 189) re-formulated the *Catnic* approach in the following three questions:

> (a) Does the variant have a material effect upon the way the invention works? If yes, there is no infringement as the variant falls outside the claim.
>
> (b) If (a) is answered in the negative, would the fact that the variant had no material effect have been obvious to the skilled reader? If not, there is no infringement either.
>
> (c) If (b) is answered in the affirmative, would the skilled reader nevertheless have understood from the language of the claim that the patentee intended that strict compliance with the primary meaning was an essential requirement of the invention? If yes, then there is no infringement as the variant falls outside the claim. If no, then the skilled reader would conclude that the patentee intended a figurative meaning rather than a literal one.

182 William Cornish, David Llewelyn and Tanya Aplin, *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights* (Sweet & Maxwell, 8th Ed, 2013) at 258 point out that whilst numerous English cases post-*Improver* have diligently applied the three questions postulated by Hoffmann J, there have been criticisms that the law was "becoming repetitious and confusing". The third question could be criticised as leading back to the core question which the question were intended to address, namely, did the patentee intend the claim to have a literal, non-contextual meaning? In *Kirin-Amgen*, Lord Hoffmann recognised (at [52]) that the questions formulated in *Catnic* and *Improver* were merely "guidelines, more useful in some cases than in others".

183 The *Catnic*/*Improver* approach has been observed to be in line with the Protocol on the Interpretation of Article 69 of the European Patent Convention (5 October 1973) ("the Protocol") (*Kirin-Amgen* at [48]). Article 69(1) of the European Patent Convention (5 October 1973, revised 29 November 2000) ("the EPC", or "the EPC 2000" when specifically referring to the revised text) provides that "[t]he extent of the protection conferred by a European patent or a European patent application shall be determined by the claims", and that "the description and drawings shall be used to interpret the claims". Article 1 of the Protocol goes on to caution against interpreting Art 69 of the EPC either to require a strictly literal approach or to mean that the claims only serve as a guideline.

184 In a recent decision of the UK Supreme Court, *Actavis UK Limited v Eli Lilly and Company* [2017] UKSC 48 ("*Eli Lilly*"), Lord Neuberger, writing for the majority, departed from the *Catnic*/*Improver* approach. After reviewing the prior English cases and European decisions under the EPC, the UK Supreme

Court held at [54] that a problem of infringement is best approached by addressing two issues, each of which is to be considered through the eyes of the skilled addressee. The issues are: (a) does the variant infringe any of the claims as a matter of normal interpretation ("Issue A"); and (b) if not, does the variant nonetheless infringe because it varies from the invention in a way or ways which is or are immaterial ("Issue B")? If the answer to either issue is "yes", there is infringement; otherwise, there is not. Issue A is simply an issue of interpretation, while Issue B raises a question that would normally have to be answered by reference to the facts and expert evidence.

185 The new approach in *Eli Lilly* was said (at [54]) to comply with the Protocol which had been amended after the *Improver* decision to include (among other minor amendments) a new Article 2 on "Equivalents" which states:

> For the purpose of determining the extent of protection conferred by a European patent, due account shall be taken of any element which is equivalent to an element specified in the claims.

186 Lord Neuberger accepted that on the facts before him, the *Improver* questions were still helpful as providing a structure for dealing with Issue B (*Eli Lilly* at [59]). That said, Lord Neuberger remarked (at [62]) that the second *Improver* question (see [181(b)] above) "should be asked on the assumption that the notional addressee knows that the variant works to the extent that it actually does work". The reformulated *Improver* questions (which are still just guidelines) are as follows (at [66]):

> (i) Notwithstanding that it is not within the literal meaning of the relevant claim(s) of the patent, does the variant achieve substantially the same result in substantially the same way as the invention, ie the inventive concept revealed by the patent?

> (II) Would it be obvious to the person skilled in the art, reading the patent at the priority date, but knowing that the variant achieves substantially the same result as the invention, that it does so in substantially the same way as the invention?
>
> (iii) Would such a reader of the patent have concluded that the patentee nonetheless intended that strict compliance with the literal meaning of the relevant claim(s) of the patent was an essential requirement of the invention?

As stated in *Eli Lilly* at [66], in order to establish infringement in a case where there is no literal infringement, a patentee would have to establish that the answer to the first two questions is "yes" and that the answer to the third question is "no".

187 *Eli Lilly* must be read whilst bearing in mind the amendment to the Protocol made in 2000, which included the new Art 2 on "Equivalents". This is in contrast with *Kirin-Amgen*, decided after the EPC 2000 but before the latter came into force, in which Lord Hoffmann had suggested at [41]–[45] that there was no place in the UK for the operation of a doctrine of equivalents that extended protection outside of the claims. In *Eli Lilly*, Lord Neuberger commented at [32] that the drafting of the Protocol bore all the hallmarks of a compromise tackling the conflict between giving the inventor an appropriate degree of protection in a particular case and the need for clarity of principle as to the extent of such protection generally. His Lordship's subsequent remark that the EPC and the Protocol apply in many different states with different traditions and approaches in relation to patent law bears underscoring.

188 Singapore is, of course, not a party to the EPC. It is not bound in any way by the Protocol even though s 113(1) of the Patents Act is modelled on s 125(1) of the Patents Act 1977 (c 37) (UK) ("the UK Patents Act 1977") and Art 69 of the EPC. It stands to reason that the courts in Singapore should be cautious in following UK and European decisions on claim interpretation, and

perhaps especially so after Art 2 on "Equivalents" was added to the Protocol (see *Ng-Loy* ([58] *supra*) at para 33.3.12, which states that our purposive approach to claim construction is not the same as the American "doctrine of equivalents" under which there is infringement if the defendant's product performs substantially the same function in substantially the same way to achieve the same results).

189 In *FE Global Electronics Pte Ltd and others v Trek Technology (Singapore) Pte Ltd and another appeal* [2006] 1 SLR(R) 874 ("*FE Global*"), the Court of Appeal stated at [14] that the purposive approach to claim construction is preferred as it balances the rights of the patentee and those of third parties. Indeed, the Court of Appeal referred to *Kirin-Amgen*, *Catnic* and the Protocol.

190 Some two years later, a differently constituted Court of Appeal came to a similar conclusion in *First Currency Choice*. The Court of Appeal at [25] endorsed the purposive construction approach (as set out in *Catnic* and reiterated in *Kirin-Amgen*) in determining the essential features of an invention. This included the point in *FE Global* that such an approach seeks to balance the rights of the patentee and those of third parties (*First Currency Choice* at [26]). V K Rajah JA added at [26] that the purposive construction of the claims gives the patentee "the full extent, but no more than the full extent, of the monopoly which a reasonable person skilled in the art, reading the claims in context, would think that he (the patentee) was intending to claim". I note that the Court of Appeal endorsed the comment by Simon Thorley *et al*, *Terrell on the Law of Patents* (Sweet & Maxwell, 16th ed, 2006) at para 6-01 that the determination of the true construction of a patent specification and its claims is one of the most

significant issues in patent litigation, because the monopoly and scope of protection granted by a patent are defined by its claims.

191 It follows that there is a clear and established line of authorities in Singapore generally endorsing and applying the approach taken in *Catnic*, *Improver* and *Kirin-Amgen*. Aside from those mentioned, other decisions include *Genelabs* (CA) ([60] *supra*) at [67]; *V-Pile Technology (Luxembourg) SA and others v Peck Brothers Construction Pte Ltd* [1997] 3 SLR(R) 981 ("*V-Pile*") at [62]; and *Merck & Co Inc v Pharmaforte Singapore Pte Ltd* [1999] 3 SLR(R) 1072 at [52]–[53].

192 Whether or not Singapore can or should take on board some form of doctrine of equivalents is not necessary for me to decide in the present case. Whilst *Eli Lilly* is a significant UK Supreme Court decision, I say no more as I have not had the benefit of arguments from counsel on this point. In any case, a significant point in *Eli Lilly* was the amendment to the Protocol and the reference to the doctrine of equivalents, which has not been endorsed by Singapore courts thus far. Much depends on what is meant by "equivalents" and the role that the doctrine plays. Is it nothing more than a factor or guide in deciding how the skilled reader will interpret the claims? Or does it operate such that the scope of protection extends beyond what the skilled reader understands the patentee to have claimed protection for, based on the words used? In any case, as will be seen, nothing turns on this on the facts before me.

Interpretation of the term "work surface"

193 Turning back to the Patent, the only aspects that are seriously in dispute between the parties are the terms "work surface" in claim 1 and "texturized work surface" in claim 21. I will examine each term more closely.

194 The Plaintiff's view is that the expression "work surface" is not a term of art, and it simply refers to the top surface of a CMP pad which will come into contact with an object or work-piece to be polished or planarised. Unused and as-received pads such as the NexPlanar Pads can fall within the claim as long as they have a feature that will be exposed to the working environment.

195 The Defendants instead argue that the "work surface" is a distinct three-dimensional upper region of a polishing pad that has exposed microelements and is softer than the lower region which has unexposed microelements. The Defendants read the term "work surface" and the rest of the language in claim 1 to teach a skilled addressee that the claim only relates to a CMP pad that is *already in use* for polishing. According to the Defendants, "work surface" must refer to a surface that has undergone the conditioning or breaking-in process, otherwise it would not be possible for the microelements to be exposed and for the work surface to be relatively softer than the subsurface.

196 On a purposive interpretation of the claim, I am of the view that the term "work surface" does not necessitate that the pad be in use, conditioned or broken-in for it to fall within the claim. While much of the claims and descriptions in the specifications go into detail about what happens when the work surface comes into contact with the working environment, this does not mean that the Patent was intended to be limited in this regard. Indeed, it would be artificial to limit the coverage of claim 1 only to used or conditioned pads, as it could very well defeat (or at least severely limit) the purpose of obtaining patent protection in the first place if new pads were excluded. Even as a matter of common sense, I am of the view that the skilled addressee would not understand the patentee to be only referring to a used or a conditioned pad by the language in claim 1.

197 I note that this interpretation is also supported by several parts of the description of the Patent, such as lines 23 to 29 on page 4, as well as lines 19 to 31 on page 23, which expressly contemplate the existence of a "work surface" before going on to describe the further step of making the work surface come into contact with the working environment. Indeed, I note that the Examples set out in the specification make clear that the work surface can be softened either by opening the microelements proximate to the work surface by skiving, abrading, puncturing, *etc*, or chemically altering or softening the microelements with the work environment.[131]

198 The Defendants raise the prosecution history of the US Patent and rely on several representations made by the Plaintiff during patent prosecution. I note that although s 113(1) of the Patents Act is silent as to whether foreign prosecution history can be relied upon to assist in claim construction, the Defendants cite one local High Court decision in which the prosecution history of a foreign patent corresponding to the patent in suit was considered (see *V-Pile* ([191] *supra*) at [74]–[75]; see also *Eli Lilly* at [88], which states that "reference to the [prosecution] file would only be appropriate where (i) the point in issue is truly unclear if one confines oneself to the specification and claims of the patent, and the contents of the file unambiguously resolve the point, or (ii) it would be contrary to the public interest for the contents of the file to be ignored").

199 In the case at hand, there is the added difficulty that the file history that is referred to relates to a foreign prosecution. In the end, even if there may be room in an appropriate case to consider foreign prosecution history given the

131 The Patent, pp 13 and 24–26.

linkages with the Singapore application as an aid to claim construction, this was not particularly necessary here. I simply make the following three broad points:

(a) First, the Defendants point to an express representation made by the Plaintiff in response to the US Patent and Trademark Office which distinguishes its two-layer invention in the US Patent from prior art which had "only one level of microelement rigidity and only one constantly eroding layer which is acted upon by forces of grinding strength".[132] The Defendants argue that this indicates that the Patent is really a two-layer pad with different levels of microelement rigidity, otherwise it would have been indistinguishable from prior art which would have been similarly capable of becoming softer upon conditioning or use.[133] Nonetheless, this does not assist the Defendants in refuting the point that claim 1 of the Patent is wide enough to include a new and unconditioned pad that would have two layers with different microelement rigidity when used or conditioned. If the Defendants then contend that this would make the Patent similar to any piece of prior art, then such a submission would more appropriately have been in respect of validity and inventive step instead (which, for clarity, would have not succeeded in any case).

(b) The Defendants also cite several arguments and representations made by the Plaintiff during the prosecution of the US Patent, which explain that the way the pad is used is vital to achieving the Patent's objective of regenerating the work surface.[134] In the same vein, I do not

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132 2DCBD, p 348.

133 Ds' Closing Submissions, paras 87–97.

134 Ds' Closing Submissions, para 108.

see how this assists the Defendants in seeking to limit the scope of claim 1 of the Patent to exclude new and unconditioned pads.

(c) Last but not least, the Defendants point out that the Plaintiff was forced to abandon certain language in claim 1 of the US Patent due to the examiner's sustained objections that the claim lacked clarity as to whether the pad is in contact with the working environment. Claim 1 of the US Patent was originally drafted to include the phrase "wherein when said article is in contact with a working environment", but this was later removed. The Defendants highlight that Mr Roberts stated during cross-examination in the trial for the present case that he contemplated that the US Patent "would be a product or an article that was exposed to a working environment including a polishing slurry".[135] Yet again, I do not think that this advances the Defendants' case. The removal of the aforementioned phrase in the US Patent does not clearly indicate the Plaintiff's intention to limit the invention to used or conditioned pads only. I note as well that there may be differences with the patentability requirements (including sufficiency) of the US Patent and Trademark Office, and I do not consider it objectionable that the Patent in suit here may include new and unconditioned pads that would invariably come into contact with the working environment and exhibit the relevant characteristics as described in the specification. It is certainly not disputed that the Patent is contemplated to be exposed to the working environment, but that does not mean that its claims cannot cover new and unconditioned pads.

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135 Ds' Closing Submissions, paras 98 to 107.

200 Finally, I turn to the Defendants' arguments in reliance on Dr Leong's report. In his report on the "NEXX-09V1" and the "NEX4-6035-30S", the only two new and unconditioned NexPlanar Pads which were tested, Dr Leong disagreed with the Plaintiff on two claim components.[136] The Defendants interpreted this to mean that Dr Leong disagreed with the Plaintiff that (i) each sample tested had a work surface; and (ii) there were polymeric microelements at the work surface of each sample. While it does appear that Dr Leong interpreted "work surface" to consist of open polymeric microelements (*ie*, upon use or conditioning), his report was focused on the factual analysis of whether the NexPlanar Pads tested infringed each component of the asserted claims rather than the question of how each claim should be interpreted. Dr Leong also expressly and rightly acknowledged that it is for the court to establish whether it is acceptable to assume that the NexPlanar Pads "would be subjected to the conventional CMP process whereby pre-conditioning of the pads is performed with diamond discs as an inherent step to create a work surface before they are being used for polishing".[137] Similarly, Dr Leong's report does not seek to answer the question of whether claim 1 can be interpreted to include new pads that would display the relevant characteristics when used for polishing. It will be recalled that the question of claim construction is ultimately a matter for the court's determination (see [19] and [176] above).

201 On a purposive interpretation, I find the term "work surface" to refer to the three-dimensional upper region of a polishing pad, which would have exposed microelements and become softer when it comes into contact with the working environment during polishing. New and unused pads that are capable of exhibiting the relevant characteristics when broken in during the polishing or

136 1DCBD, pp 116–117 and 177–178.

137 1DCBD, p 108.

planarising process, in my view, are not precluded from falling within claim 1. In light of my finding, there is no need for me to consider whether preconditioning of the pad is a necessary step to *create* the work surface prior to use.

Interpretation of the term "texturized work surface"

202 Claim 21 of the Patent differs from claim 1 only by the inclusion of the word "texturized" to describe the work surface of the pad. The Defendants' position is that the word "texturized" emphasises that the polymeric microelements on the work surface have already been opened from use or conditioning. The Plaintiff, however, advances the view that "texturized" means that a microtexture, minitexture and/or macrotexture (*eg*, grooves) have been created on the pad's work surface during the pad manufacturing process, for example, by laser.

203 The Defendants' strongest evidence is the inconsistent evidence from Prof Schultz about the meaning of "texturized work surface". Prof Schultz's report appears to take "texturized work surface" to refer to the surface when "polymeric microelements are opened by the diamond conditioning process". The report goes on to state that:

> An unused, as-received pad has an untexturized surface meaning that it has no "work surface" within the context of [the Patent]. The process of diamond conditioning prior to polishing opens microelements, creates a texturized surface and hence generates a "work surface".

In a later affidavit dated 7 November 2016 and during his cross-examination, Prof Schultz took the Plaintiff's (and Prof Gutmann's) position as to the meanings of "work surface" and "texturized work surface", and claimed that the Defendants had misunderstood his statements about these terms which had been

taken out of context.[138] The Defendants characterised this change in position as a *volte-face*. I do not think that the Defendants' reading of Prof Schultz's statements is unfair, and I have taken these inconsistencies into account in my decision. That said, none of this suffices to displace the clear position established by the language of the Patent.

204 The Patent specification is clear in using the words "texture", "texturized" and their variants to refer to processes during the manufacture of the pad, rather than during the use or conditioning of the pad. Under the section titled "Background of the Invention", the specification explains the terms "textured", "microtexture", "minitexture" and "macrotexture". I reproduce the description of "microtexture" as an example:[139]

> Conventional polishing pads typically have textured surfaces. The "microtexture" of a pad is the intrinsic microscopic bulk texture of the pad after manufacture. Some of the factors which influence the static morphology or microscopic bulk texture of a conventional pad are the nature and texture of the work surface, such as waves, holes, creases, ridges, slits, depressions, protrusions and gaps, and the size, shape, and distribution, frequency or spacing of individual features or artifacts. In typical polishing pads, the microtexture of the pad is largely random and *is the result of factors intrinsic to the manufacturing process*. Because of the large number of variables in the manufacturing process, few attempts have been made to control variables such as pore size, shape and distribution. …
>
> [emphasis added]

205 The illustrative examples of the invention outlined in the specification also use the terms "texture" and "texturize". For instance, Example 5 states:[140]

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138 Affidavit of Prof Schultz dated 7 November 2016, JMS-10, paras 7 to 21; NE Day 3, pp 62–63.

139 The Patent, pp 2–3.

140 The Patent, p 19.

> The texture 26 may be formed upon at least a portion of the work surface 18 by mechanical texturizing methods, such as machining, embossing, turning, grinding, replicating and lasering the work surface 18. *One of ordinary skill in the art would understand that the texture 26 may be formed by a variety of other mechanical work or chemical methods*, such as etching, for example.
>
> By texturizing the work surface 18, up to 50% or more surface area may be exposed to facilitate removal of dross during polishing. In addition, texturing of the work surface 18 enhances the polishing action by exposing a greater number of microelements 16' to the working environment. …
>
> [emphasis added]

206 The Patent specification is unequivocal and clear that the term "texturized work surface" refers to an outcome of the pad manufacturing process, and not the conditioning or polishing process. I further note that based on the Defendants' interpretations of "work surface" and "texturized work surface", there would have been no difference between the two terms and it would be puzzling why claims 1 and 21 are separate claims. Last but not least, the invention here is described in the Patent as "*an article of manufacture* for altering a surface of a workpiece" [emphasis added].[141] Thus, I accept the Plaintiff's interpretation of this phrase and find that claim 21 can also cover new, unused and unconditioned pads.

207 In reaching my decision, I bear in mind that the inventive concept underlying the claims is the use of hollow, flexible, organic, polymeric microelements in a CMP polishing pad. The skilled reader would approach claim construction with the inventive concept in mind. Lord Neuberger in *Eli Lilly* at [60] rightly underscored the important part inventive concept plays in claim interpretation. In determining how the invention works, the court should focus on the "problem underlying the invention" or the "inventive concept".

141 The Patent, p 4, lines 19–20.

The question as to whether any element (such as the "spring" in *Improver*) is essential to the invention is likewise one that the skilled addressee will approach with reference to the inventive concept (*Eli Lilly* at [65]).

208 If the Defendants were correct in their defence that only a purchaser of the NexPlanar Pads who actually used the pads for CMP polishing could be the infringer,[142] the issue would have to be decided in accordance with the principles on joint tortfeasorship. I have however found against the Defendants' construction of the patent claims in question for the reasons set out earlier. Because of this, there is no need for me to consider the issue of whether the Defendants should be liable for infringement by manufacturing and selling new and unconditioned pads while knowing that the use of such pads by the customer would constitute an infringement of the Patent when the pads were used, conditioned or broken in. I note in passing, however, that our Patents Act does *not* contain a provision along the lines of s 60(2) of the UK Patents Act 1977, which provides for infringement by supplying the means relating to an essential element of the invention to another person for putting the invention into effect.

209 That said, as learned counsel for the Plaintiff submits, the law does not require the court to interpret a product claim in a manner that limits protection to actual use. In *Virgin Atlantic Airways Ltd v Jet Airways (India) Ltd and others* [2013] RPC 10 (affirmed on appeal), the patent was for a passenger seating system for an aircraft. Claim 1 comprised 22 features, including a "plurality of seat units" with "said seat units being arranged to form a column defining a notional longitudinal column axis". The defendant asserted that there was no infringement unless the seat units were arranged in accordance with the claims, and argued that this was not done by the defendant but by the airline customer.

142 Ds' Opening Statement, paras 21 and 23.

Floyd J rejected this argument, holding at [104] that the skilled reader would understand that a system of the kind described in the patent would only need to be fully assembled on board an aircraft. The fact that the defendant supplied the purpose-built system (albeit not completely assembled but with instructions) did not assist the defendant.

210 Even if my decision that the Defendants have infringed the patent by making and/or disposing of the NexPlanar Pads in question is wrong, and infringement only takes place when the pads are actually conditioned for use by a customer, the possibility of liability as joint tortfeasor remains. This will be considered later under the section on joint tortfeasorship.

Whether the three tested NexPlanar Pads infringe the asserted claims

211 Having determined the issue of whether new and unconditioned pads can fall within the asserted claims, the next question is whether the NexPlanar Pads in question do in fact infringe the asserted claims. Dr Leong's evidence and report on the experiments conducted on three of the NexPlanar Pads assisted me greatly in this inquiry.

212 I pause to note that there was some disagreement between the parties over what was meant by Tay J's comment that there was "to be no challenge as to the parameters of the experiments" referred to in the Independent Assessor's Report.[143] As I stated at trial, I do not interpret Tay J's statement to mean that the Defendants are precluded from making submissions to the court as to the probative value of the experiments that were conducted.[144]

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143 NE of hearing on 16 November 2015.

144 NE Day 1, pp 16–17.

213 The Defendants thus advance the main contention that the Plaintiff's tests and retests are of little probative value given their failure to expose the pads to slurry. The tested pads were only abraded manually with sandpaper. According to the Defendants, this did not simulate the conditions stipulated in the Patent. Having considered the parties' arguments, I do not consider this experimental limitation to be fatal to the Plaintiff's case on infringement as the Defendants contend. This was taken into consideration by Dr Leong, who was nonetheless still agreeable to most of the facts that the Plaintiff was seeking to prove, as the tests and observed data showed that the microelements in the tested NexPlanar Pads bore "striking resemblance to the chemistries of Expancel" and had similar characteristics such as being soft, flexible and puncturable.[145] The use of sandpaper to abrade the microelements was simply a way of opening the microelements at the work surface, thereby softening the work surface. The Defendants have not clearly articulated why the omission of slurry is such a critical aspect. In fact, based on Dr Moinpour's testimony at trial, the slurry would have made the tested pad softer;[146] this would have potentially made it easier for the Plaintiff to prove the claim component that the exposure of the work surface to the working environment would cause the work surface to be relatively softer compared to the subsurface. I therefore do not find the omission of slurry and the use of sandpaper to condition the pads to significantly affect the probative value of the tests conducted before Dr Leong.

214 I turn to consider Dr Leong's findings as stated in the Independent Assessor's Report. There appears to be no dispute as to Dr Leong's findings that the facts sought to be proved by the Plaintiff in respect of the dependent claims (claims 2, 3, 8, 10, 11 and 12; see [6] above) have in fact been satisfactorily

145 1DCBD, p 108.

146 NE Day 8, pp 133–135.

made out. Although Dr Leong could not conclude on the basis of tested NexPlanar Pads alone whether they were in fact polishing pads, this is not in dispute either. There remain only two components in both claims 1 and 21 in respect of which Dr Leong disagreed with the Plaintiff:

(a) whether each tested NexPlanar Pad has a work surface and a subsurface proximate to the said work surface; and

(b) whether there is one portion of the said polymeric microelements being at the said work surface and exposed to a working environment including a polishing slurry.

215 Dr Leong's disagreements were due to a different interpretation of the terms "work surface" and "texturized work surface", as discussed above at [200]. He noted however that "the closed microelements are very near to the top surface and can be exposed if conditioned with abrasive forces",[147] and that "the microelements are opened as a result of the polishing process" while "the microelements at the subsurface remain closed (intact)".[148]

216 In respect of the used pad "E7980-30S-25-70TS-4CF" which was tested, Dr Leong agreed with the Plaintiff entirely. On the basis of topographical scanning electron microscope ("SEM") images, the used pad showed "a textured surface with opened hollow microelements, which agree well to the definition of a work surface". From cross-sectional SEM images, the pad's "subsurface containing closed microelements can be easily identified below the work surface".[149] The microelements at the work surface and subsurface were

147 1DCBD, p 116.

148 1DCBD, p 118.

149 1DCBD, p 147.

confirmed to be polymeric upon further testing.[150] The pad also contained macrotexture in the form of grooves on the pad's surface to promote slurry transport across the pad surface.[151]

217 I briefly note that Dr Leong did not agree that the tests showed that the work surface of the used pad was more compressible and softer than the subsurface, as measurement was only performed on the work surface. However, the Defendants do not seriously challenge the general proposition that the work surface of a pad softens upon exposure to the working environment. After all, this principle was mentioned by both sides' experts during the proceedings (see [166] above). This was also observed by Dr Leong in respect of the two new NexPlanar Pads during testing.[152] There is more than enough evidence for the court to draw an inference that this was also a feature of the "E7980-30S-25-70TS-4CF" pad.

218 It therefore appears that upon the proper construction of the terms "work surface" and "texturized work surface", the findings in the Independent's Assessor's Report indicate that all of the components of the asserted claims were present in the tested NexPlanar Pads.

Whether the remaining nine untested NexPlanar Pads infringe the asserted claims

219 That said, only three NexPlanar Pads were tested, and the Plaintiff's infringement claim is in respect of 12 NexPlanar pads in total. No tests were performed in respect of nine of the NexPlanar Pads, and no explanation was

150 1DCBD, pp 147–148.

151 1DCBD, p 163.

152 See, for example, 1DCBD, p 136.

proffered during the parties' submissions as to why this was the case. The Plaintiff simply argues that six of the nine untested NexPlanar Pads were voluntarily disclosed by the Defendants themselves in their supplementary lists of documents dated 6 July 2013 and added to the amended statement of claim, and that the Defendants did not claim that the untested pads were different from the tested pads. The Plaintiff cites s 108 of the Evidence Act (Cap 97, 1997 Rev Ed) to argue that the burden should have been upon the Defendants to prove any differences among the NexPlanar Pads, as these differences would have been facts "especially within the knowledge of" the Defendants.

220 In my view, s 108 of the Evidence Act does not apply in the present situation as I do not consider any fact here to be "especially within the knowledge of" the Defendants. It was open to the Plaintiff to test the nine remaining pads in the same way that they tested the three pads. It does not seem to me that the Plaintiff was truly unable to procure samples of these pads for testing, nor was such a point raised during submissions.

221 It is insufficient for the Plaintiff to simply point to the Defendants' voluntary disclosure of the pads in their lists of documents. Even if the Defendants did so under the view that the pads were relevant and necessary to the litigation, this does not go any way towards establishing by way of some form of implied admission that these pads do infringe the asserted claims of the Patent, or that these pads are so similar to the tested pads that they would likewise be found to infringe the Patent if the tested pads are found to be infringing. I am not prepared to draw a conclusion as to the 12 pads with evidence on only three pads before me. Accordingly, the Plaintiff has not discharged its burden of proving that the nine untested NexPlanar Pads infringe the Patent, and I dismiss any claims of infringement with regard to these pads.

Whether the Defendants' actions amount to infringement of the NexPlanar Pads

222 The Plaintiff relies on the following acts of the Defendants to establish infringement of the Patent:

(a) the 1st Defendant's sale of (or offer to sell) the NexPlanar Pads to the 2nd Defendant around late 2010 to the first quarter of 2012, for the purpose of the 2nd Defendant's sale, offer to sell, importation, use or keeping of the NexPlanar Pads;

(b) the 2nd Defendant's importation, use or keeping of the NexPlanar Pads around late 2010 to the first quarter of 2012; and

(c) the 2nd Defendant's sale of (or offer to sell) the NexPlanar Pads to United Microelectronic between late 2010 and the first quarter of 2012.

223 The Defendants do not dispute that all of the above acts did in fact take place.[153] These acts and transactions were evidenced by documents such as order forms, invoices and shipment documents.[154] It is clear that the Defendants' acts amount to the disposal, importation and/or keeping of a patented product without the consent of the patentee, and therefore infringement within the meaning of s 66(1) of the Patents Act (see [174] above).

224 I pause to note that infringement only arises if the infringing acts take place in Singapore. There is no evidence that the infringing pads were made in Singapore. Indeed, they appear to have been made overseas by the 1st

153 See, for example, NE Day 9, p 65.

154 In respect of "NEXX-09V1", see 5ABD, p 1184; in respect of "NEX4-6035-30S", see 5ABD, pp 1192, 1195–1196; in respect of "E7980-30S-25-70TS-4CF", see 5ABD, pp 1224–1225 and 6ABD, pp 1263, 1355, 1359, 1415.

Defendant. As against the 1st Defendant, the claim is that they disposed or offered to dispose the infringing pads to the 2nd Defendant in Singapore. While there is limited evidence as to where the acts or offers of disposal took place, there is certainly evidence that the 1st Defendant's technicians came to Singapore to meet with representatives of the 2nd Defendant as well as representatives of the 2nd Defendant's customers such as United Microelectronics.[155] Even if this is not a sufficient basis to find that the 1st Defendant disposed of the infringing pads or made the offers of disposal in Singapore, I find that the 1st Defendant is in any case liable as a joint tortfeasor with the 2nd Defendant for the reasons set out below.

Whether the Defendants may be regarded as joint tortfeasors

225 The doctrine of joint tortfeasorship has been recognised in Singapore law, and can be divided into two broad categories (*Trek Technology (Singapore) Pte Ltd v FE Global Electronics Pte Ltd and others and other suits* [2005] 3 SLR(R) 389 ("*Trek*") at [35]): (a) where one party conspires with the primary party or induces the commission of the tort; or (b) where two or more persons join in a common design pursuant to which the tort is committed.

226 I observe at the outset that the law on joint tortfeasorship is complex. The factual scenarios in which joint tortfeasorship may arise are numerous and varied. They include: (i) A and B committing a joint act in pursuance of a common design; (ii) A committing an act/tort whilst engaged in a common venture with B; and (iii) A committing an act/tort arising out a common design with B. Within these broad scenarios, issues as to the relevance of knowledge (actual or constructive), incitement, inducement and control may arise. Special

155 See P's Closing Submissions, paras 50–51; NE Day 4, pp 73–74 and 80–81.

considerations might also be applicable in the case of liability of directors for torts of the company (see generally *Airtrust (Singapore) Pte Ltd v Kao Chai-Chau Linda and another suit* [2014] 2 SLR 673). Joint tortfeasorship might perhaps even relate to concepts and statutory provisions such as "authorisation" (in copyright law; see, for example, s 31(1) of the Copyright Act) or "providing the essential means" (under s 60(2) of the UK Patents Act 1977). Caution may be necessary where the claim is primarily rooted on mere enablement, assistance or encouragement (*Twentieth Century Fox Film Corp v Newzbin Ltd* [2010] EWHC 608 (Ch) at [90] in the context of authorisation of infringement in copyright law).

227 In *Ong Seow Pheng and others v Lotus Development Corp and another* [1997] 2 SLR(R) 113 at [44], the Court of Appeal cited with approval Lord Templeman's statement in *CBS Songs Ltd v Amstrad Consumer Electronics plc* [1988] AC 1013 at 1057 that "joint infringers are two or more persons who act in concert with one another pursuant to a common design in the infringement". It is also established law that the agreement does not have to be in writing: a tacit agreement is sufficient (see *Unilever Plc v Gillette (UK) Limited* [1989] RPC 583 at 609).

228 The Plaintiff mainly relies on the second category of "common design", contending that the Defendants acted in concert and in furtherance of the infringement pursuant to a common design, and may therefore be regarded as joint tortfeasors. In respect of this second category, Lai Kew Chai J in *Trek* at [37] elaborated that "two persons who agree on common action in the course of and to further which one of them commits a tort in this country are joint tortfeasors".

229 In *Towa Corp v ASM Technology Singapore Pte Ltd and another* [2017] 3 SLR 771, Lee Seiu Kin J, citing *Susanna Leong* at para 19.045, noted at [124] that the finding of joint tortfeasorship by common design "requires the discharge of a heavy evidentiary burden on the part of the plaintiff", and that the threshold for such a finding is a high one. The joint tortfeasors must have been "so involved in the commission of the tort as to make himself liable for the tort" (*Sabaf SpA v MFI Furniture Centres Ltd* [2002] EWCA Civ 976 at [59]).

230 The Defendants argue that the relationship between them was merely that of a buyer and seller, and that this is insufficient to establish a common design such as would support the conclusion of joint tortfeasorship. Mr Chang's evidence was that the 2nd Defendant would request CMP pads from suppliers such as the 1st Defendant, who would fulfil the order by shipping the requested pads to the 2nd Defendant, either for testing or resale onwards to the 2nd Defendant's customers.

231 However, the evidence suggests that the 1st Defendant was more than a mere "passive" seller to the 2nd Defendant, as the 1st Defendant was clearly involved in the 2nd Defendant's sale of the NexPlanar Pads to customers such as United Microelectronic.

232 Not only was it conceded by Mr LaCasse during cross-examination that the 1st Defendant knew that the NexPlanar Pads would be sold to United Microelectronics,[156] the Plaintiff also presented evidence showing that the 1st Defendant communicated and dealt with customers such as United Microelectronics directly. As noted above at [224], Mr Chang testified that the 1st Defendant's technicians would fly from Taiwan or the US to attend trilateral

156 NE Day 9, pp 65–66.

meetings in Singapore with the 2nd Defendant's sales representatives and representatives from United Microelectronics.[157] Mr Chang agreed during cross-examination that it was very important for the 1st Defendant to know what the customer wanted at the evaluation stage. The Plaintiff also adduced an e-mail from the 1st Defendant's technical marketing manager to the 2nd Defendant's representatives, which showed that the 1st Defendant was aware that it was providing samples for evaluation by United Microelectronics.[158] Although much of this evidence does not explicitly and specifically relate to the three NexPlanar Pads found to be infringing, the Defendants' general conduct was sufficient basis to infer that the 1st Defendant's involvement in the 2nd Defendant's resale of the pads extended to the infringing pads as well.

233 I find that the Plaintiff has proven that the 1st Defendant was not merely acting as a supplier of the infringing pads, but that it also made the 2nd Defendant's infringing acts its own. The Defendants may properly be regarded as joint tortfeasors in that they have acted in concert and in furtherance of the infringement pursuant to a common design to sell the infringing pads to United Microelectronics.

Some observations on whether the Defendants might be liable as joint tortfeasors with the customers of the 2nd Defendant

234 Finally, for completeness, I return to the issue dealt with earlier on the Defendants' liability extending to new and unconditioned CMP pads. If the decision that the Defendants infringed the Patent by making and/or disposing of the new NexPlanar Pads in question is wrong, infringement only taking place

157 NE Day 4, pp 73–74.

158 1ABA, p 651; NE Day 9, pp 6–8.

when the NexPlanar Pads are conditioned for use by a customer, the possibility of liability as joint tortfeasors remains.

235 Reference was made by the Plaintiff to *Rotocrop International Limited v Genbourne Limited* [1982] FSR 241 ("*Rotocrop*"). In that case the patent related to a compost bin. The defendant was sued for infringement by the manufacture and sale of the compost bin in "kit form". The defence, *inter alia*, was that the acts complained of had started before the UK Patents Act 1977 had come into force. Under the earlier Patents Act 1949 (c 87) (UK), there was no statutory provision on liability for supplying the essential means to work an invention. Graham J (at 259) did not doubt that if s 60(2) applied, the defendant would be liable under that statutory provision. Nevertheless, Graham J found (at 260) that the same conclusion was reached: first, because on a purposive construction, the reference to the compost bin included "a kit of parts"; and second, because the defendant was a joint tortfeasor with the customers who assembled the compost bin from the kit of parts. The learned judge dealt with the absence of positive proof of what the customers had done with the kit of parts and completed bin by inferring that the bins must have been erected and used for making compost by the customers. On this basis, it appears that common design was inferred, and even if that was wrong, the evidence supported joint tort liability on the basis of procurement (at 260).

236 Whilst *Rotocrop*'s reasoning is attractive, problems may arise when it is applied here to any claim that the Defendants are joint tortfeasors with the customer/end user who acquires the NexPlanar Pads, conditions and puts them to use in a CMP process. First, there is almost no evidence as to what the customers of the 2nd Defendant did with NexPlanar Pads that were supplied. Second, even if it may be said that the court can infer the customers would have

used the NexPlanar Pads in the manner envisaged in the Patent, it is unclear whether that use took place in Singapore. No infringement action was brought against United Microelectronics. No witness from United Microelectronics gave evidence.

237 To be clear, these points are raised by way of passing comment since I have decided that the Defendants are in any case liable for the acts of disposing, offering to dispose and use of the claimed invention in Singapore. On the basis of the claims as construed above, I have rejected the Defendants' submission that the Patent is only infringed when the pads are actually conditioned or used.

Conclusion

238 In summary, the Patent was valid prior to its expiry. The asserted claims of the Patent were infringed by the Defendants' actions, but only in respect of NexPlanar Pads "NEXX-09V1", "NEX4-6035-30S" and "E7980-30S-25-70TS-4CF".

239 Therefore, a declaration of the Patent's validity is granted to the Plaintiff, as well as a declaration that the asserted claims were infringed by the Defendants. I dismiss the Defendants' counterclaims in their entirety.

240 Although the Plaintiff has succeeded in proving infringement, I see no reason to grant any of the injunctions sought by the Plaintiff on the basis that the Patent has already expired. There is no longer any need to accord the Patent prospective protection from further infringement.

241 As this trial was bifurcated and proceeded on liability only, damages and/or account of profits and the question of election will be assessed separately.

I will deal with the issue of costs at the conclusion of the trial on damages and/or account of profits as relevant.

242 I thank the lead counsel Mr Tan Tee Jim SC and Mr Low Chai Chong and their legal teams for the most helpful submissions. I also acknowledge and record the court's appreciation of the considerable efforts of Dr Leong, the appointed court assessor. The case has raised many points of patent law. Indeed, numerous case authorities were cited to the court. Whilst not all have been expressly referred to in the judgment, the court acknowledges the effort of counsel. The issues include the problematic area of joint liability and the position of an individual who is said to have supplied the essential means to work a claimed invention. Whether the law in this area will benefit from legislative action is, of course, a matter for consideration by Parliament and the relevant law reform authorities.

George Wei
Judge

Tan Tee Jim SC, Christopher de Souza, Darrell Wee Jiawei and Jasper Nathanael Lim Shih Hao (Lee & Lee) for the Plaintiff;
Low Chai Chong, Long Ai Ming, Alvin Lim Jun Hao and Kenneth Fok Quan Wei (Dentons Rodyk & Davidson LLP) for the Defendants.