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Opposition - Decision Issued

MINTER ELLISON
Level 40
1 Farrer Place
Sydney NSW 2000
Australia

Application number	2021261902
Applicant name	Ecograf Limited
Opponent	Dorfner Anzaplan GmbH and Renascor Resources Limited

Dear Sir/Madam,

Please find attached a copy of a Decision of a Delegate of the Commissioner of Patents.

This decision may be appealed to the Federal Court. You can obtain more information from the website – www.fedcourt.gov.au.

Yours sincerely,

Tatiana Garzon
Oppositions and Hearings
Phone: 02 62832455

This data, for application number 2021261902, is current as of 2026-11-07 05:40 AEDT

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AUSTRALIAN PATENT OFFICE

Renascor Resources Limited & Dorfner Anzaplan GmbH v Ecograf Limited **[2024] APO 13**

Patent Application:	2021261902
Title:	Method of producing purified graphite
Patent Applicant:	Ecograf Limited
Opponents:	Renascor Resources Limited (first opponent) & Dorfner Anzaplan GmbH (second opponent)
Delegate:	L. F. McCaffery
Decision Date:	18 March 2024
Hearing Date:	23 October 2023 by videoconference
Catchwords:	**PATENTS** – opposition under section 59 – novelty – inventive step – support – sufficiency – clarity – manner of manufacture – oppositions successful on the grounds of inventive step, sufficiency, support and clarity – other grounds unsuccessful – costs awarded – applicant given opportunity to amend.
Representation:	Counsel for the applicant: Ben Fitzpatrick Patent attorney for the applicant: Richard Baddeley of WRAYS Counsel for the first opponent: Neil Murray SC and Nicola Gollan Patent attorney for the first opponent: Nigel Lokan of Minter Ellison Counsel for the second opponent: Ian Horak KC Patent attorney for the second opponent: Stephen Friend of Golja Haines & Friend

IP AUSTRALIA

AUSTRALIAN PATENT OFFICE

Patent Application:	2021261902
Title:	Method of producing purified graphite
Patent Applicant:	Ecograf Limited
Date of Decision:	18 March 2024

DECISION

The oppositions are successful.

Claims 1 to 16 and 20 to 25 lack inventive step in view of each of D2, D13 and D14.

The specification does not provide a clear enough and complete enough disclosure beyond the use of spheroidal and flake graphite in the process of the invention.

Claims 1 to 25 are not supported in respect to the use of the process for the purification of graphite materials other than flake and spheroidal graphite.

Claims 1 to 25 are not clear as the term "graphite material" is not clear in scope. Claim 17 lacks clarity due to the term "low temperature".

The applicant has two (2) months from the date of this decision to file amendments to overcome the deficiencies.

Costs according to Schedule 8 in each opposition are awarded against the applicant, EcoGraf Limited.

REASONS FOR DECISION

Background

1. Australian patent application 2021261902 was filed on 14 May 2021 by Ecograf Limited (referred to in this decision as **the applicant** or **Ecograf**) under the provisions of the Patent Cooperation Treaty. The application claims an earliest priority date of 18 May 2020 based on Australian provisional application 2020901589. The application entered the national phase on 3 November 2021, and (expedited) examination was requested on 24 November 2021. An adverse report issued on 30 November 2021, and following a response from the applicant on 1 December 2021, acceptance of the application was advertised on 16 December 2021. Nothing in the present opposition turns on these particular matters.

2. Notices of opposition were filed by Renascor Resources Limited (**Renascor**) and Dorfner Analysenzentrum und Anlagenplanungsgesellschaft mbH (**Dorfner**)[1] on 16 March 2022. Both opponents filed their statement of grounds and particulars (**SGP**) on 16 June 2022.

3. The following table provides a summary of the oppositions, including the various amendments made to the SGP. Dorfner raised the grounds of support, manner of manufacture, novelty and inventive step. Renascor raised the grounds of clarity, best method, clear enough and complete enough disclosure (sufficiency), support, novelty and inventive step.

<table>
<tr><th></th><th>Dorfner</th><th>Renascor</th></tr>
<tr><td>SGP</td><td>Filed 16 June 2022</td><td>Filed 16 June 2022</td></tr>
<tr><td>Amended SGP</td><td>Filed 16 September 2022
(Allowed 10 October 2022)</td><td>Filed 11 April 2023
(Allowed 26 April 2023)</td></tr>
<tr><td>2nd Amended SGP</td><td>Filed 15 May 2023
(Refused 3 July 2023)</td><td></td></tr>
<tr><td>3rd Amended SGP</td><td>Filed 14 July 2023
(Allowed 11 August 2023)</td><td></td></tr>
<tr><td rowspan="4">Evidence in Support (EIS)</td><td>Stephen Friend (Friend 1), dated 12 September 2022 and Exhibits SRF-1 to SRF-10.</td><td>Yangshuai Qiu (Qiu 1), dated 13 September 2022 and Exhibits YQ-1 to YQ-5.</td></tr>
<tr><td>Stephen Friend (Friend 2) dated 15 September 2022 and Exhibits SRF-11 to SRF-13.</td><td>Jack Laurence Stanley (Stanley) dated 15 September 2022 and Exhibits JLS-1 to JLS-34.</td></tr>
<tr><td>Christian Graf (Graf 1) dated 14 September 2022 and Exhibits CG-1 to CG-8.</td><td rowspan="2">Reiner Haus (Haus 2) dated 12 September 2022 and Exhibit RH-1.</td></tr>
<tr><td>Reiner Haus (Haus 1) dated 12 September 2022.</td></tr>
<tr><td rowspan="2">Evidence in Answer (EIA)</td><td colspan="2">Peter Adamini (Adamini) dated 16 December 2022 and Annexures PA-1 to PA-8.</td></tr>
<tr><td colspan="2">Christoph Frey (Frey) dated 19 December 2022 and Annexures CF- and CF-2.</td></tr>
</table>

[1] Amended notices of opposition were filed on 22 March 2022 and 10 June 2022 to correct the name of the opponent. Dorfner subsequently changed their name to Dorfner Anzaplan GmbH on 29 August 2022. An amended notice of opposition was filed on 27 February 2023 to reflect that change.

Evidence in Reply (**EIR**)	Stephen Friend (**Friend 3**) dated 14 March 2023 and Exhibit SRF-14.	Yangshuai Qiu (**Qiu 2**), dated 20 February 2023.
	Christian Graf (**Graf 2**) dated 13 March 2023.	

4. The matter was heard on 23 October 2023. At the hearing Renascor pressed the grounds of novelty, inventive step, section 40(2)(a) ("sufficiency"), and section 40(3) (support and clarity). Dorfner pressed the grounds of novelty, inventive step, sufficiency, section 40(3) (support and clarity) and manner of manufacture.

5. I note that while the two opponents prosecuted and presented their oppositions separately, they relied on much of one another's evidence and the applicant's evidence in answer to each opposition was essentially the same.[2] The significant overlap between the two oppositions permitted both oppositions to be heard at the same time and the parties facilitated the hearing process by minimising repetition in their oral submissions. This has allowed me to write a single decision for the two separate oppositions. Nevertheless, there was some dispute between the parties as to the evidence that could be relied on, and the grounds that could be argued in each opposition. I have dealt with these issues as required below.

Onus

6. The substantive amendments to the *Patents Act 1990* (Cth) (the **Act**) brought about by the *Intellectual Property Laws Amendment (Raising the Bar) Act 2012* (Cth) (the ***Raising the Bar Act***) apply to the present case. The standard of proof in opposition proceedings is the balance of probabilities. If the Commissioner is satisfied, on the balance of probabilities, that a ground of opposition to the grant of the standard patent exists, the Commissioner may refuse the application. The opponent bears the onus of proof.

Principles of Construction

7. The principles underpinning construction are well-established. As noted by Middleton J in *Eli Lilly and Company Limited v Apotex Pty Ltd*:

> "It is well settled that the Court should, from the outset, approach the task of patent construction with a generous measure of common sense. The Court must place itself in the position of a person skilled in the relevant art, being the subject matter of the patent. From this perspective, the patent is to be read as a whole, in the context of the specification and in light of the prevailing common general knowledge and state of the relevant art at the priority date."[3]

8. The task of construing the specification is undertaken from the viewpoint of a person skilled in the art and the prevailing common general knowledge at the priority date. The person skilled in the art is a hypothetical non-inventive person or team likely to have a practical interest in the subject matter of the invention.[4]

9. The Full Court in *Airco Fasteners Pty Ltd v Illinois Tool Works Inc*., recently reiterated the principle that experts can give evidence on the meaning which those skilled in the art would

[2] Note: for the Dorfner opposition, Friend 2 annexed the Qiu 1 declaration, and Friend 3 annexed the Qiu 2 declaration.
[3] [2013] FCA 214; 100 IPR 451 at [139].
[4] *Root Quality Pty Ltd v Root Control Technologies Pty Ltd* [2000] FCA 980 at [70]-[72].

give to technical or scientific terms and phrases and on any unusual or special meanings that would be given by skilled addressees to words which might otherwise bear their ordinary meaning, and the Court is to place itself in the position of some person acquainted with the surrounding circumstances as to the state of the art and manufacture at the time. However, it is for the Court, not for any witness however expert, to construe the specification.[5] A similar approach is taken in matters before the Commissioner. Justice Rofe in *Sandoz AG v Bayer Intellectual Property GmbH* added that when construing claims a generous measure of common sense should be used, a construction that would lead to an absurd result is to be avoided, and it is impermissible to approach the issues of construction with any regard to the alleged infringing articles.[6]

The expert witnesses

10. For Renascor, evidence was provided by the following witnesses:

    Dr Reiner Haus. Dr Haus has a PhD in Applied Geology and has been Managing Director at Dorfner since 2001. He was previously Head of Research and Development at Dorfner. Dr Haus' evidence for Renascor related to a presentation he gave in November 2019 which was relied on in both oppositions (referred to below as D2 and D3). This was essentially a confirmation of the slides he presented and his understanding that the material was made available to conference attendees.

    Dr Yangshuai Qiu. Dr Qiu is a Lecturer and Master Supervisor at the School of Resources and Environmental Engineering at Wuhan University of Technology in Wuhan, People's Republic of China.

11. Mr Jack Stanley, a solicitor at MinterEllison, also provided a declaration. This declaration set out the publication dates for the documents relied on by Renascor in the opposition.

12. For Dorfner, evidence was provided by the following experts:

    Dr Reiner Haus. As noted above, Dr Haus also gave evidence for Renascor. His evidence for Dorfner also related to D2 and D3. His evidence focussed on the general approach to choosing a purification method appropriate for the impurities in graphite ore.

    Dr Christian Graf. Dr Graf has a PhD in Inorganic Chemistry and is currently Director of the Processing Division in Dorfner. He was previously Manager, Global Marketing and New Business Development at Rockwood Lithium/Albemarle.

13. Declarations were also provided by Mr Stephen Friend, the Australian attorney for Dorfner. His first declaration relates to the references relied on by Dorfner in the opposition. Renascor agreed that Dorfner could rely on evidence by Dr Qiu, and Mr Friend provided a supplementary declaration which included a copy of Dr Qiu's evidence, as well as details of the references relied on in Renascor's opposition.

14. For the applicant, evidence was provided by the following witnesses:

    Mr Christoph Frey. Mr Frey has a Mining Engineering Degree, and is currently Managing Director at ProGraphite GmbH, a company providing consulting and laboratory services to graphite businesses. He has worked for the applicant, including as a Director between August 2016 and April 2020, and is the named inventor for the present application.

[5] [2023] FCAFC 7 at [48].
[6] [2023] FCA 1321 at [151] to [152].

Mr Peter Adamini. Mr Adamini has a Degree in Mineral Science and Chemistry. He is currently a Lead Metallurgist at Independent Metallurgical Operations Pty Ltd.

15. Both opponents cautioned that the evidence of Mr Frey should be carefully scrutinised because he is the named inventor.[7] Renascor also submitted that, to the extent of any disagreements, the evidence of Dr Qiu should be preferred over that of Mr Adamini. They noted that Mr Adamini has worked on various projects for the applicant, while Dr Qui is entirely independent of all parties in the opposition. Furthermore, they argued that Mr Adamini is not representative of the person skilled in the art as he has little direct experience in graphite beneficiation processes,[8] but rather has more generalised experience in operations across a range of commodities.[9]

16. On the other hand, the applicant disputed Renascor's submissions that Dr Qiu had over 10 years' experience in the field of graphite beneficiation before the priority date,[10] noting that in the period leading up to the priority date he was either studying or working on his post-doctoral research which related to the preparation and application of natural graphite-based composites. While Dr Qiu stated that he has collaborated with industry, the nature and timing of that collaboration is unclear, and he does not appear to have ever worked directly in the commercial purification of graphite. The applicant argued that given his lack of practical experience, the views of Dr Qiu as to the approach he would have taken in response to hypothetical questions put to him does not reflect the approach that the notional skilled person would have taken at the priority date.[11]

17. I have taken the various submissions from the parties into account when determining the weight that evidence can be given.

The common general knowledge

18. As indicated above, construction is undertaken from the perspective of the person skilled in the art and the prevailing common general knowledge at the time. As Aickin J stated in *Minnesota Mining & Manufacturing C. v Beiersdorf (Australia) Ltd*:

> "The notion of common general knowledge itself involves the use of that which is known or used by those in the relevant trade. It forms the background knowledge and experience which is available to all in the trade in considering the making of new products, or the making of improvements in old, and it must be treated as being used by an individual as a general body of knowledge."[12]

19. As noted by the High Court in *Aktiebolaget Hassle v Alphapharm*, information cannot be treated as part of the common general knowledge unless the is evidence of its general acceptance and assimilation by persons skilled in the art.[13]

20. There was little dispute between the parties on the common general knowledge in the present case, though the applicant expressed some reservations about several submissions made by the opponents. I have detailed these below.

21. Graphite is one of four naturally occurring forms of carbon. The predominant types are crystalline flake (single crystals of graphite larger than 1 μm) and micro-crystalline (dense

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[7] Dorfner submissions (**DS**) at [100], Renascor submissions (**RS**) at [31].
[8] Beneficiation, in this case, refers to the purification of graphite.
[9] RS at [32].
[10] RS at [29].
[11] Applicant submissions (**AS**) at [85] to [88].
[12] [1980] HCA 9; (1980) 144 CLR 253 at 292.
[13] [2002] HCA 59 at [31].

graphite masses composed of microcrystals of about 0.01-1 μm in size).[14] Spherical graphite is manufactured from flake graphite concentrates by rounding to give spherical particles. The spherical particles are capable of being spread thinly and uniformly in manufacturing processes and are used for the anode material in lithium-ion batteries.

22. Impurities have a deleterious effect on battery performance.[15] Natural graphite contains a number of impurities, including:

    a. Mineral impurities, including feldspar, quartz, mica, chlorite, pyrite, hematite/limonite and calcite, and
    b. Non-mineral impurities, including silicon, aluminium, iron, calcium, potassium, sodium, sulfur and phosphorus.[16]

23. Apparently almost all graphite ores contain the gangue minerals quartz, feldspar, mica and hematite/chalcopyrite, though the specific content of each of these impurities varies. In this context, the term "gangue" refers generally to unwanted impurities that surround or are closely mixed with a desired material in an ore. The term "beneficiation" refers to any process that improves the physical or chemical properties of a mined ore and includes physical or chemical processes.[17]

24. The first stage of graphite beneficiation involves physical processing. This generally involves grinding and flotation, which can increase graphite purity to as much as 98%. An alternative physical process involves heating graphite concentrate to a temperature of 2800-3000°C to vaporise impurities. This achieves purities of >99.99% but has the disadvantages of high cost and low processing capacity.[18]

25. With the exception of high temperature treatment, physical processes alone are unable to achieve greater than 98% purity. Some undesirable gangue minerals will collect in the graphite concentrate and some are found intergrown in the graphite flakes. The latter impurities require chemical purification. Thus, physical processes are generally followed by chemical purification to achieve purity of >99%.[19]

26. The opponents referred to two prior art chemical processes that were used to increase graphite purity to above 99%.

    The hybrid acid method. This process involves treatment with a mixture of hydrofluoric acid (HF) and other acids (such as hydrochloric, sulfuric or nitric acids), which react with impurities to solubilise (or dissolve) them. HF was generally used, rather than hydrochloric, sulfuric or nitric acid, because of its ability to react with and dissolve silicate mineral impurities. This method generally obtained purity of >99.98%.[20] Treatment with HF provides graphite with high purity, but HF is highly toxic and hazardous to use, as well as having negative environmental impacts.[21]

    The alkali-acid method. Two processes were referred to by the opponents. These commence with either an alkali roast (alternatively referred to in the art as an alkaline

[14] Qiu 1 at [24].
[15] Specification at page 1, lines 8 to 12.
[16] Qiu 1 at [27] to [28].
[17] Qiu 1 at [29] to [30].
[18] Qiu 1 at [32].
[19] Qiu 1 at [33].
[20] Qiu 1 at [35].
[21] Qiu 1 at [36].

bake or caustic bake), or an alkali leach.[22] An alkaline roast involves contacting graphite with sodium hydroxide at an elevated temperature (typically between 400°C and 600°C), whereby the molten sodium reacts with silicate mineral impurities.[23] In an alkali leach, graphite is contacted with an aqueous solution of sodium hydroxide at a lower temperature (typically around 160°C to 180°C) under high pressure (0.6 to 1.0 MPa). High pressure is required to achieve sufficient reactivity.[24] The alkaline roast or leach is followed by an acid leach step. The acid leach generally uses sulfuric or hydrochloric acid at atmospheric pressure and a temperature of 60°C to 80°C. Impurities react with the acid to form water-soluble species that can be removed from the graphite. These processes can provide purity of greater than 99.95%.[25] The reagents used in these processes have lower environmental impacts but are more complex and have higher production costs compared to the hybrid acid method.[26]

27. The applicant expressed some reservations in relation to the opponents' submissions on these processes. The first was the suggestion that the hybrid acid and alkali-acid methods were equally accepted as being suitable for the commercial purification of graphite to the high levels required for use in lithium batteries and other applications. They submitted that it was apparent from the evidence that the generally accepted and preferred method was flotation followed by acid leaching, generally using HF. They acknowledged that other methods (caustic bake, caustic leach and thermal purification) were also known, but noted there were a range of technical and commercial reasons why these alternate methods were not as generally accepted.[27]

28. The second reservation related to what they considered was a conflation by the opponents of the alkaline roast and alkaline leach processes into a single method. They submitted that the two processes are fundamentally different, particularly in terms of the conditions used and the level of purity obtained.[28] They further submitted that the same reservations applied to submissions made by Dorfner, which they argued mischaracterised the claimed invention as a combination of two existing graphite purification processes.[29]

29. I agree with the applicant's submissions that the alkali roast and alkali leach processes are fundamentally different processes, though they are intended to achieve similar outcomes. I also accept that the hybrid acid process was the *preferred* method for purifying graphite. However, while alkali-acid methods may not have been preferred, or even widely used, in commercial settings, I do not consider it follows that they were not common general knowledge. Notably, all of the experts stated that they were aware of alkali roast and alkali leach processes, as well as the advantages and disadvantages associated with the use of each.[30] On balance I am satisfied that these are common general knowledge.

The specification

30. The field of the invention is said "to relate to a method of producing purified graphite and relates particularly, though not exclusively, to such a process for producing battery-grade

[22] The term "alkali" is used interchangeably in evidence with other terms such as caustic and NaOH. The term "roast" is used interchangeably with the term "bake".
[23] Qiu 1 at [38].
[24] Qiu 1 at [39].
[25] Qiu at [41].
[26] Qiu 1 at [42].
[27] AS at [157].
[28] AS at [159].
[29] AS at [161].
[30] See Frey at [35] to [39], Adamini at [32], Qiu at [37] to [44].

spherical purified graphite (**SPG**)".[31] The specification states that a great deal of effort is being expended to find a more cost-effective, non-toxic and environmentally sustainable process for the purification of spherical graphite.[32] The present invention has been developed with a view to providing a cost-effective and environmentally sustainable method of producing purified graphite with carbon content higher than 99.9%.[33]

31. The specification goes on to state that, according to one aspect of the invention, there is provided a method comprising the steps of:

> subjecting graphite material to a sodium hydroxide (NaOH) bake;
> releasing any remaining NaOH using water;
> subjecting the graphite material to a first acid wash;
> neutralising and washing the acid washed graphite material to deliver an intermediate purified graphite product;
> subjecting the intermediate purified graphite product to a NaOH leach;
> releasing any remaining NaOH in the intermediate purified graphite product using water;
> subjecting the intermediate purified graphite product to an acid wash; and,
> neutralising and washing the intermediate purified graphite product to deliver a final purified graphite product.

32. There were no significant differences between the parties as to the meaning of the terms used in the claim. Indeed, much of the arguments were based on the invention involving, and using well-known terms associated with, known alkali-acid methodologies.[34]

33. The present invention uses a sodium hydroxide bake at a temperature between 450°C and 550°C.[35] Preferably the graphite is mixed with aqueous sodium hydroxide (50%) and heated in a furnace at 500°C for 30 minutes. Remaining sodium hydroxide is then "released", preferably by immersion in hot water, followed by washing and filtering.[36] A first acid wash,[37] preferably using dilute sulfuric acid is performed, preferably at a temperature of 80°C for 25 to 45 minutes. The mixture is then neutralised by washing with water and filtered to provide an intermediate purified graphite product.[38] The specific example (summarised in Table 1) obtains a carbon content in the intermediate purified graphite product of 99.96% (generally referred to hereinafter as the **intermediate product**).

34. The intermediate product is then subjected to a series of additional purification steps. The first of these involves a sodium hydroxide (NaOH) leach. There was no apparent dispute between the parties in relation to this term, but the specific process used in the present application differs from the "typical" alkaline leach used in the alkali-acid leach method (as described above), which uses high temperature and increased pressure.[39] In particular, the

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[31] Specification at page 1, lines 3 to 5.
[32] Specification at page 1, lines 12 to 23.
[33] Specification at page 2, lines 9 to 11.
[34] DS at [6].
[35] Specification at page 3, lines 4 to 9.
[36] Specification at page 3, lines 10 to 14.
[37] I note that the claim uses the term "acid wash" rather than "acid leach", which is used in the prior art documents D13 and D14, so there is an argument that the term "wash" could be taken to be broader than the recognized meaning in this particular context. However, Dr Qiu's evidence in relation to the prior art alkali-acid leach processes uses the same language as the present claims (see Qiu 1 at [41]). Assuming that Dr Qiu was not aware of the present application when he gave this evidence, I consider that the terms "acid wash" and "acid leach" can be taken to be synonymous in the context of alkali-acid leach processes.
[38] Specification at page 3, lines 24 to 30.
[39] D2 and D13 refer to the treatment of graphite with aqueous sodium hydroxide at increased temperature and pressure as an alkaline leach. D13 indicates that similar conditions (and terminology) are used in the Bayer process for the purification of aluminium.

present invention is said to preferably involve immersing the intermediate product in aqueous sodium hydroxide and heating for between 1.5 and 2.5 hours at a temperature between 77°C and 93°C.[40] There is nothing in the specification, read in isolation, that would suggest that the process may be done at higher temperature and pressures as used in the typical alkali-acid method.

35. The difference between the conditions used in the prior art alkali-acid leach method and those specifically described for the present invention was also noted by Dr Qiu, who stated that:

> "I consider that the 'NaOH leach' described in this passage is a known process, which I was aware of at the Priority Date but was not a common operation because at this concentration and temperature of the sodium hydroxide solution, I would expect the reaction between the sodium hydroxide and impurities to be very slow. However, this NaOH leach is being conducted after the initial alkaline bake and acid wash, which is why I understand that the temperature used is lower and high pressure is not being used. That is, where there is a prior alkaline roast step, I understand this would have removed the majority of impurities and I would expect a low reactivity alkaline leach to be effective to remove small amounts of remaining impurities."[41]

36. Dr Frey addressed these comments in his EIA, and stated that:

> "...the NaOH leach as practised in the process of the invention was not a common operation before the priority date. Wang (D13) also discloses an NaOH leach in an autoclave, i.e. under pressure, at 150 to 270°C which is markedly higher than the 72 to 88°C temperature range Dr Qiu extracts from page 4 of the patent specification. Practising an NaOH leach after a caustic roast-acid leach process before the priority date was not well-known."

37. The evidence before me raises some issues as to the meaning of "NaOH leach" in the present context. In particular, it appears that the "typical" alkali-acid leach method is understood to employ higher temperatures under increased pressure in order to achieve sufficient reactivity for digestion of impurities in the crude graphite starting material.[42] That is, in the context of typical acid-alkaline leach methods, it seemed that the term "alkaline leach" might have an art-specific or special meaning inasmuch as it is done at elevated temperatures and pressure. I therefore sought verbal submissions at the hearing on the meaning that should be given to the term "NaOH leach" in the present specification. In short, Renascor submitted that there was no special meaning for the term and noted the claim does not exclude the use of higher temperatures and pressures than those given in the specification. On the other hand, the applicant submitted that it is an oversimplification to refer to the present process as a combination of two known processes – rather the invention lies in a multi-step process comprising all of the steps. In that context they argued that the term must be construed in light of the disclosure in the specification and read as being limited to the use of the specific conditions described in the specification.

38. Despite my concerns as to the meaning that should be given the term, I do not find the applicant's submissions persuasive. As noted by Justice Rofe in *Sandoz v Bayer*, reference is made to the specification to understand the background and context of the claims and to ascertain the meaning of technical terms. Terms in the claim which are unclear may be clarified or defined by reference to the body of the specification, but the plain and

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[40] Specification at page 7, lines 5 to 12.
[41] Qiu 1 at [138].
[42] Qiu 1 at [39].

unambiguous meaning of a claim cannot be varied or qualified by reference to the body of the specification.[43]

39. In the present case, the specification uses specific conditions for the treatment of the intermediate product. However, as noted by Renascor, the caustic leach defined in the present claims is not explicitly limited to any those conditions. No evidence was provided on the ordinary meaning of the term "leach", but the evidence on hand suggests to me that it would be understood in the art that leaching can be carried out using different conditions. Thus, in the typical alkali-acid method, sufficiently high reactivity is achieved using appropriate conditions of high temperature and pressure. Leaching may also be performed at lower temperatures and atmospheric pressure, such as is used in the acid leach step. Furthermore, the specification indicates that "low" temperatures and pressures are used for the alkaline leach, but these are said to be *preferable* or *typical* of the conditions used. On balance, I am not satisfied that this implicitly limits the term to the use of such conditions. To read down the ordinary meaning of the term leaching to the specific conditions described in the specification would therefore, in my opinion, import an impermissible gloss into the claims.

40. The material is then subjected to a step of "releasing" remaining sodium hydroxide. There was some dispute between the parties as to the meaning that should be given to the phrase "releasing any remaining NaOH" since this impacted on the novelty determination. Mr Adamini considered that the terminology used requires that all of the caustic is removed prior to acid treatment.[44] In the first instance, Dr Qiu stated that the process of releasing any remaining caustic as described in the specification at page 6, lines 7 to 14, is a standard way of washing following a caustic step.[45] However, in the context of the novelty determination, Dr Qiu subsequently noted that the particular terminology is not commonly used, and opined that the step might not result in complete removal of sodium hydroxide. He went on to state that:

> "Having regard to the description in the Patent Application, and in particular claims 6 to 8, page 7, lines 13-19 and Figure 2 (steps 36 and 38), I understand that the Patent Application breaks the washing process into two discrete steps, being: a first step of 'releasing any remaining' NaOH and a second step of washing to neutral. I understand that 'releasing any remaining NaOH' using water in claim 1 means the step where the graphite material is immersed in water to dissolve and dilute NaOH that is adhered to the surface of the graphite… I understand that the Patent Application refers to the second step of washing to neutral as a separate step to the 'releasing any remaining NaOH' step…"
>
> He went on to state that he would not expect the "releasing" step to result in a product that was entirely free of NaOH since even after filtration some NaOH would remain on the surface of the graphite material, unless the "releasing" step was repeated many times.[46]

41. On balance I agree with the applicant's submissions on this point. As an initial point, I note that Dr Qiu initially read the release step as being "standard" for this type of process, and the alternative interpretation was made in view of the prior art being considered under the ground of novelty. However, it is it is well established that issues of construction are approached without regard to the alleged infringement (or in this case an alleged anticipation).[47] That aside, the claim defines that *any* residual NaOH is released from the intermediate purified graphite product. I understand this to mean that (essentially) all NaOH is released from the

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[43] *Sandoz v Bayer, supra* at [154].
[44] Adamini at [55].
[45] Qiu 1 at [143].
[46] Qiu 2 at [50].
[47] *Welcome Real-Time SA v Catuity Inc*., [2001] FCA 445; (2001) 51 IPR 327 at [21].

graphite material. The opponent's submissions on this point are to the extent that the NaOH is "released", but not washed free of the graphite material. However, it would seem to me that this hypothetical situation would result in the intermediate graphite material containing "residual" NaOH and not meeting the requirement that any residual NaOH is released. Indeed, Dr Qiu acknowledged that the release step could be repeated to release all residual NaOH. Thus, while the specification appears to distinguish between the step of releasing NaOH[48] and those of washing and filtering (including a "neutral wash"[49]), I consider that a common-sense interpretation would require that the intermediate purified graphite material is substantially free of NaOH following the "release" step. In this regard, I note that the release and washing steps are aimed at not only removing residual NaOH, but also other impurities including more-slowly dissolving impurities.[50] It appears that the release step is aimed at the removal of the caustic residue, while subsequent washing removes other less-soluble impurities.

42. Finally, the graphite is subjected to a second acid wash. The specification states that the wash is preferably performed using a dilute acid at a temperature of about 80°C for approximately 35 minutes.[51] The specification states that the use of the sodium hydroxide leaching step, with low consumption of chemicals, can increase the carbon content of the final purified graphite material to 99.98%.

Novelty

43. An invention is taken to be novel when compared with the prior art base unless it is not novel in light of certain types of prior art information, each of which must be considered separately.[52] For the purposes of the present consideration, the following kinds of information are relevant:

- Prior art information made publicly available in a single document or through doing a single act;
- Prior art information made publicly available in 2 or more related documents, or through doing 2 or more related acts, if the relationship between the documents or acts is such that a person skilled in the relevant art would treat them as a single source of that information.

44. It is well-established that the general test for anticipation is the reverse infringement test:

> "The basic test for anticipation or want of novelty is the same as that for infringement and generally one can properly ask oneself whether the alleged anticipation would, if the patent were valid, constitute an infringement."[53]

45. Thus, the test is satisfied if the alleged anticipation discloses all of the essential features of the invention as claimed. Furthermore, as stated by the Full Court in *AstraZeneca v Apotex*:

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[48] For example, at page 7, lines 13 to 16, and step 36 in Figure 2.
[49] For example, at page 7, lines 17 to 19, and step 38 in Figure 2.
[50] See Graf 2 at [5], which states that there is a risk that compounds solubilized during caustic treatment could be precipitated on the solid graphite if acid treatment occurs without washing the graphite with water beforehand. This evidence was in relation to D2, and statements by Dr Frey to the extent that the washing steps were not disclosed in D2. I understand Dr Graf's evidence to be that the alkali-acid processes implicitly require washing between caustic and acid leach steps. See also Qiu 2 at [22], which similarly suggests that wash steps were routine in alkali-acid leach processes.
[51] Specification at page 4, lines 13 to 19.
[52] Subsection 7(1) of the Patents Act.
[53] *Meyers Taylor Pty Ltd v Vicarr Industries Ltd* [1977] HCA 19 at [20]; 137 CLR 228 at [235].

> "… for a prior art document to be anticipatory, there must be … a clear description of, or clear instructions to do or make, something that would infringe the patentee's claim if carried out after the grant of the patentee's patent."[54]

46. A classic formulation of this principle was given in *General Tire v Firestone*, which stated that the prior art "must contain clear and unmistakable directions to do what the patentee claims to have invented… 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."[55]

47. The opponents referred to the same prior art under the ground of novelty.

> **D1**: CN 103449425[56]
>
> **D2**: Slides of Dorfner ANZAPLAN GmbH presentation, "Graphite Purification: Alternatives, Challenges and Cost", Los Angeles 12.11.2019.[57]

48. There was no dispute that these documents were published before the priority date of the present application. For completeness, I note that D2 is the slide deck that accompanied Dr Haus' presentation at the Graphite + Anodes 2019 conference. Video and audio recordings of the presentation were also entered into evidence (hereinafter **D3**). Dr Haus confirmed that these were the slides projected during his presentation. He also stated that his understanding from the conference promotional materials is that attendance at the conference was open to any member of the public upon registration.[58]

49. The applicant referred to portions of the recorded presentation in support of their oral submissions. Renascor disputed whether D3 was available to the parties in the Renascor opposition. In particular, they had deleted D3 from their SGP in an amendment dated 11 April 2023, and my understanding of their oral arguments is that D3 therefore could not be relied upon by the parties in the Renascor opposition. I disagree with this submission. Regulation 5.23 is only necessary where the document that the Commissioner wishes to have regard to has not been filed in the opposition. As noted by the delegate at the time they allowed the amendment, the recording was entered into the opposition by Renascor. While an amendment to the SGP may be required for Renascor to reintroduce the document in the opposition, removal of D3 from their SGP did not remove D3 from the filed evidence. The parties also had the opportunity to file evidence and make submissions on D3 during the opposition. I therefore do not consider that any action is required in order for me to have regard to this document.

Novelty with respect to D1 (Renascor: Claims 1, 7, 19, 20 and 22; Dorfner: Claims 1, 7 and 20).

50. D1 is said to relate to a method of preparing high purity natural flake graphite. The method involves the steps of high-temperature alkali treatment, aqua regia[59] acid treatment, secondary alkali treatment, and, finally, "synergistic complexation" treatment.[60]

51. Specifically, the process involves the purification of high-carbon natural flake graphite. The high-temperature alkali treatment involves addition of a 30% aqueous solution of sodium

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[54] *AstraZeneca AB v Apotex Pty Ltd* [2014] FCAFC 99 at [301].
[55] *The General Tire & Rubber Company v The Firestone Tyre and Rubber Company Limited* [1972] RPC 457 at 485-486.
[56] Exhibit JLS-1. The translation provided as Exhibit JLS-3 is referred to here.
[57] Exhibit JLS-2.
[58] Haus 2 at [3] to [4].
[59] Aqua regia is a mixture of concentrated nitric acid and hydrochloric acid.
[60] D1, abstract.

hydroxide to natural flake graphite, placing the mixture in a muffle furnace, and heating at 700 to 750°C for 2 to 2.5 hours. The mixture is then washed with deionized water until the filtrate is neutral. The alkali-treated natural flake graphite is then treated with aqua regia at room temperature for 1 to 1.5 hours, and then washed with deionized water until the filtrate is neutral.

52. At this point I note that there are several significant differences between the first two steps of the process described in D1 and the specific examples described in the present application. Firstly, D1 is directed to the purification of *flake* graphite, whereas the present specification mainly relates to the purification of spherical graphite. Dr Qiu stated that he considered that the present process would likely be more effective at purifying spherical graphite due to its small particle size than flake graphite.[61] While spherical graphite and flake graphite contain similar impurities, in his experience spherical graphite is easier to purify due to its smaller size.[62] Secondly, the alkaline roast step is carried out at 700-750°C in D1, whereas the present specification uses temperatures in the range of 450 to 550°C.[63] Dr Qiu stated that the temperature used in D1 was higher than he would suggest for an alkaline roast step.[64] Finally, treatment with aqua regia is done at room temperature, whereas the present process uses acids at elevated temperatures. The present specification indicates that elevated temperatures are used to increase reactivity.[65] Presumably the stronger acid, aqua regia, enables the use of lower temperatures in the acid wash step.

53. I do not consider the present claims can be distinguished based on differences identified above. While much of the background and the specific embodiments described in the specification are directed at the purification of spherical graphite, the claims are not limited to such. Furthermore, while Dr Qiu suggests that flake graphite may be more difficult to purify than spherical graphite, there is no evidence that the present processes would not be suitable for the purification of flake graphite. Similarly, the present claims are not limited to any particular acid or conditions in the acid wash step.

54. The subsequent steps in the process described in D1 are more relevant in the novelty determination. Following aqua regia treatment the graphite material is subjected to a second alkali treatment with 35% aqueous sodium hydroxide at room temperature for 1 to 1.5 hours. The product is washed with deionized water until a pH of 7.5 to 8 is obtained in the filtrate. D1 states that:

> "due to the treatment of the previous two steps, most of the impurities have been eliminated but there are still metal salts and part of SiO_2 that are not eliminated, so impurities that are not eliminated in the previous two steps and can react with alkali are eliminated by using the secondary alkali treatment and an alkaline condition for a complexation treatment in the fourth step is created."[66]

55. Dr Qiu described the second alkali treatment as an alkaline leach step, though he was not sure whether it would be necessary to include this alkaline leach in the method as he would expect that using nitric acid (as part of the aqua regia treatment) would result in graphite being purified to a high degree.[67]

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[61] Qiu 1 at [161].
[62] Qiu 1 at [165].
[63] Frey at [52].
[64] Qiu 1 at [114].
[65] Specification at page 3, lines 15 to 23.
[66] D1 at [0026].
[67] Qiu 1 at [118].

56. The graphite material is then treated at room temperature for 2 to 2.5 hours with oxalic acid. This process is referred to as a synergistic complexation, which is said to involve the following chemical reactions:[68]

$$H_2L + OH^- \rightarrow HL^- + H2O$$

$$HL^- + OH^- \rightarrow L^{2-} + H2O$$

$$M + L \rightarrow [ML]$$

$$M + nHL \rightarrow [M(HL)_n]$$

57. Thus the "synergistic effect" or reaction between the alkali remaining from the previous step (OH^-) and oxalic acid (H_2L) provides mono- and di-oxalate species (HL^- and L^{2-}) that form multi-level complexes ([ML] and $[M(HL)_n]$. These water-soluble complexes remove metal ions that are not eliminated by the aqua regia treatment.[69]

58. This, in my opinion, is the key distinguishing feature. D1 requires specific mass ratios of sodium hydroxide and natural flake graphite, and washing following the caustic treatment provides a pH of 7.5 to 8. These conditions ensure that there is sufficient residual NaOH for reaction with oxalic acid in the synergistic complexation step. As previously discussed, I consider that the definition in the present claims of *any* residual NaOH being released requires that (substantially) all NaOH is removed from the graphite material. While Dr Qiu opined that the releasing step would result in residual NaOH remaining on the surface of the graphite, he provided no specific details such as the quantity that would remain in such a case. As argued by the applicant, Dr Qiu's evidence on this point does not rise above mere speculation.

59. Much of the opponents' cases were based on the present invention being a combination of known alkali-acid leach processes. The underlying chemistry of these processes differs significantly from the synergistic complexation processes shown above. As shown in the chemical reactions above, the NaOH treatment step in D1 is done under conditions that provide for residual NaOH that reacts with oxalic acid in the subsequent step. This includes the use of reaction conditions that appear to avoid significant reaction of NaOH with the graphite material, including treatment at room temperature for a relatively short time.[70] This appears to differ significantly from the prior art leach processes which the evidence suggests requires high temperature and pressure to drive reaction of NaOH with gangue minerals. Furthermore, rather than (direct) reaction of an acid with impurities as occurs in an alkali-acid leach process,[71] the synergistic complexation reaction involves an acid-base reaction between oxalic acid and NaOH to form oxalate ions which then complex with metal ions in the graphite. Thus, the synergistic complexation process (being the combination of specific steps) and acid-alkali leach appear to be distinct processes aimed at specific types of impurities.

60. In summary, the present claims are novel in view of D1.

Novelty with respect to D2 (Renascor: Claim 1; Dorfner Claims 1).

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[68] The reaction schemes given in D1 have been reproduced here without any changes. It appears that the charges on the metal ions and oxalate species are omitted in the third and fourth reaction schemes.

[69] D1 at [0032].

[70] No evidence was provided specifically on D1, but Dr Qiu considered that reaction of sodium hydroxide at 77 to 93°C, as used in the present invention, would be very slow. D1 uses even milder conditions and shorter times (35% NaOH solution at room temperature for 1-1.5 hours), so presumably the conditions would be even less reactive.

[71] See D13 and D14 for a detailed description of the chemistry, as well as the less-detailed description of the chemistry provided in Qiu 1 at [41].

61. As noted above, D2 is a PowerPoint presentation which was made by Dr Haus at a conference on 12 November 2019.

62. The main point of dispute relates to slide 16 of the presentation (a copy of the slide is shown in Attachment B). The slide shows two flowcharts. The first one flow shows a caustic bake process comprising the steps of caustic bake, water wash, acid leach, and wash. Dr Qiu considered that these steps correspond to the first four steps defined in Claim 1.[72] The second flow chart shows a caustic leach process comprising the steps of caustic leach, water wash, acid leach, wash and finally filtration. Dr Qiu considered that these steps correspond to the last four steps defined in Claim 1.[73]

63. The two flowcharts shown in slide 16 clearly relate to different processes. However, Dr Qiu noted that the final dot point on slide 16 states "Combinations possible". He stated that this is directly suggesting that the process outlined in the first flow chart be performed in combination with the process in the second flow chart.[74] The opponents argued that the inclusion of the note that "combinations possible" is a clear and unmistakable direction to the skilled person that the two flow charts can be combined to form a single process. To that end, they submitted that *"a single piece of prior art (like a recipe book) may anticipate more than one thing. The fact that a reader may choose not to follow one path does not negate the disclosure of the other path"*.[75]

64. In contrast, the applicant submitted that slide 16 provides no instruction as to what the term "combinations possible" means.[76] At the hearing they noted that the first flow chart (the caustic bake) was discussed in detail in slide 15 and that slide 16 is clearly directed to a caustic leach process. They further noted the references to the increasing complexity of the caustic leach process and submitted that the side-by-side presentation of the flow charts illustrates this point. To that end, the first flow chart is shown in a fainter font than the second flow chart (and the same flow chart shown in previous slide 15 which provided details of caustic bake processes).

65. As an initial point, I note that both opponents adduced evidence from Dr Haus, including evidence related to his presentation. However, despite this being a matter of dispute in the evidence, no evidence was adduced from Dr Haus as to the meaning of slide 16, or indeed what was disclosed during the presentation. Nevertheless, the key consideration is what the skilled person would have understood from the document, so I draw no inferences in that regard.

66. On balance I agree with the submissions made by the applicant. Indeed, the opponents' submissions, and Renascor's analogies with recipe books, appear to acknowledge that D2 does not provide a specific disclosure of the particular combination defined by Claim 1. In any case, and as noted by the applicant, *"anticipation is deadly but requires the accuracy of a sniper, not the firing of a 12 gauge shotgun."*[77] As stated by Beach J in *SNF (Australia) Pty Limited v BASF Australia Ltd*:

> "It is not sufficient to demonstrate that a prior publication is capable of being carried out in a manner which would equally infringe or not infringe the particular claim. In such a case there would not be the relevant anticipation. To elaborate, if the prior art is a

[72] Annex YQ-5.
[73] *Ibid.*
[74] Qiu 1 at [227].
[75] RS at [80].
[76] Adamini at [59].
[77] *Apotex Pty Ltd v Sanofi-Aventis* (2008) 78 IPR 485, 524 at [91].

> document and there is ambiguity in the sense that the disclosure can be read in two or more ways, such that one way would, if carried out, infringe, and one or more other ways would not, then there has been no anticipation. Anticipation must not merely be a possibility or even a likely consequence of performing the invention disclosed by the prior art, but it must necessarily be entailed in or an inevitable result of carrying out the disclosure."[78]

67. In the present case, no explanation is given in the slide as to what is meant by "combinations possible". Contrary to the opponents' submissions, I do not consider this vague reference can be considered clear and unmistakable directions to any particular combination of processes or steps, let alone the specific combination defined in the present claims. In this regard the opponents relied on Dr Qiu's evidence to support their submissions that D2 provides clear and unmistakable directions to the present invention. However, I note the evidence relied upon was given after he had been shown the present application. Dr Qiu had earlier provided evidence in relation to inventive step which specifically discussed the disclosure in slide 16. He identified the two different alkali-acid processes and went on to state that it would have been obvious to combine those two *separate* processes.[79] There is no indication at that stage that he understood the slide to disclose a combination of the two processes. However, having subsequently been given the present application he stated that:

> "After I had provided my comments above, Minter Ellison asked me to provide my opinions as to how the methods disclosed in D2 compare to claim 1 of the Patent Application. As I discussed above at paragraphs 106 to 108, on page 16 of D2, there is a slide titled "Graphite Purification", which contains two flow diagrams. As I explained at paragraph 109, in response to the Second Hypothetical Question, one approach that I would have been led to try would be to conduct the process which is outlined in the flow diagram on the left-hand side of the page first, as it involves an alkaline bake-acid leach process. I would then try conducting the second process on the right-hand side of the page second, being the alkaline leach-acid leach (as may remove further impurities, but is not as effective as removing impurities by an alkaline bake-acid leach process, which is why I would perform that first).
>
> However, on further review of page 16 of D2, I noticed that page 16, the final bullet point on the page states "Combinations possible". This suggests to me that this page is directly suggesting that process outlined in the flow diagram on the left-hand side (involving the alkaline bake-acid leach process) be performed in combination with the diagram on the right-hand side of the page (involving the alkaline leach-acid leach process)."

68. I consider it arguable whether Dr Qiu is stating here that D2 actually *discloses* the combination of the two processes. But even if Dr Qiu is indeed stating that D2 discloses the specific combination of the two processes, rather than merely *suggesting the direct suggestion* that the two separate processes be combined, I consider that little weight can be given to this evidence. It was only after being taken back to the document after reading the present application that Dr Qiu formed this view. In my opinion, the assertion that D2 discloses the present invention is based on an *ex post facto* mosaic of the information given in D2 to arrive at the claimed invention. Even if D2 discloses the individual steps of the process, I do not consider that it provides clear and unmistakable directions to the particular combination defined by the present claims.

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[78] [2019] FCA 425 at [1724].
[79] Qiu 1 at [107] to [109].

69. Finally, while I have found that the Powerpoint slides of Dr Haus' presentation do not disclose the present invention, the opponent's submissions strongly suggest that they consider the present invention was disclosed in the presentation. For completeness, I have therefore had regard to the recording provided in D3.[80] Consistent with the applicant's submissions, the side-by-side presentation accompanies comments as to the increased complexity of the caustic leach process. The additional steps are said add to the complexity, but also provide opportunities and parameters that can be adjusted or tailored after an initial investigation of the nature (or quality) of the impurities. There is no apparent suggestion that the caustic bake and caustic leach processes are done consecutively or in combination. To the extent that it may be relevant, I consider this supports my finding in relation to D2.

70. In short, I am not satisfied that D2 anticipates the invention defined by Claim 1.

Conclusion on novelty

71. The present claims are novel in view of documents D1 and D2.

Inventive Step

72. Section 7(2) of the Act sets out that an invention is taken to involve an inventive step unless it would have been obvious to the person skilled in the art in the light of the common general knowledge, either considered alone or together with information of the kind set out in section 7(3) of the Act. Nicholas J provided a succinct statement of principles relevant to assessing inventive step in *Hood v Bush Pharmacy Pty Ltd*:

> "Section 7(2) of the Act uses the word 'obvious' in the course of describing what must be established before an invention can be held not involve an inventive step. Something may be 'obvious' in light of the common general knowledge, or the common general knowledge coupled with the relevant s 7(3) information, if it is 'plain or open to the eye or mind, something which is perfectly evident to the person thinking on the subject' or something which 'would at once occur to anyone acquainted with the subject and desirous of accomplishing the end'.
>
> An invention may also be obvious in light of the common general knowledge if the person skilled in the art faced with the same problem as the inventor would have taken as a matter of routine whatever steps might have led from the prior art to the invention, whether they be the steps of the inventor or not or (using the language of the 'modified Cripps question') if the person skilled in the art would be directly led as a matter of course to take such steps in the expectation that doing so might well produce a useful or better alternative to the prior art. However, a claimed invention is not obvious merely because the person skilled in the art would consider that it was 'worthwhile to try'."[81]

73. In formulating the problem, care must be taken if incorporating information from the specification into the problem:

> "If the problem addressed by a patent specification is itself common general knowledge, or if knowledge of the problem is s 7(3) information, then such knowledge or information will be attributed to the hypothetical person skilled in the art for the purpose of assessing obviousness. But if the problem cannot be attributed to the hypothetical person skilled in the art in either of these ways then it is not permissible to attribute a knowledge of the

[80] D3 at 11.50 to 12.55 minutes.
[81] [2020] FCA 1686 at [116]-[117] (citations omitted).

problem on the basis of the inventor's "starting point" such as might be gleaned from a reading of the complete specification as a whole."[82]

74. Regardless of whether or not the present invention is a combination of two known processes, to all intents and purposes the present invention is a combination of various steps. In the case of such combination inventions, the key consideration is whether the combination as a whole, rather than each integer in the combination, is inventive. As stated in *Minnesota Mining & Manufacturing Co v Beiersdorf (Australia) Ltd*:

> "In the case of a combination patent the invention will lie in the selection of integers, a process which will necessarily involve rejection of other possible integers. The prior existence of publications revealing those integers, as separate items, and other possible integers does not of itself make an alleged invention. It is the selection of the integers out of, perhaps many possibilities, which must be shown to be obvious."[83]

75. It is also important to note the requirement for a reasonable expectation of success. This is explicit in the expectation that an approach "might well" succeed, and implicit in the characterisation of steps as those to be taken as a matter of routine.[84] However, success need not be guaranteed: "the relevant test is not knowing that steps will or would or even may well work, but merely expecting that the steps may well work."[85] Further, it is possible that the skilled person might be directly led to try more than one alternative expecting that each may well produce a useful or desired result.[86]

76. Dorfner made submissions on obviousness based on the common general knowledge alone, as well as common general knowledge combined with each of D1 and D2 (as identified above). They also adopted the submissions made by Renascor in relation to other documents.[87] Renascor made submissions on obviousness based on common general knowledge in conjunction with each of documents D1, D2 and D4 to D15:

D4: CN 111072023	D5: CN 108059157
D6: CN 102701198	D7: CN 104591155
D8: US 2787528	D9: CN 108751188
D10: Bhima Rao *et al*., "Preparation of high pure graphite by alkali digestion method", Scandinavian Journal of Metallurgy, 2004, 33(5), 257-260	
D11: Wang *et al*., "Preparation of high-purity graphite from a fine microcrystalline graphite concentrate: Effect of alkali roasting pre-treatment and acid leaching process", Separation Science and Technology, 2016, 51(14), 2465-2472	
D12: Lu *et al*., "Preparation of high-purity and low-sulphur graphite from Woxna fine graphite concentrate by alkali roasting", Minerals Engineering, 2002, 15, 755-757	

[82] *AstraZeneca AB v Apotex Pty Ltd* [2014] FCAFC 99 at [203].
[83] [1980] HCA 9; 144 CLR 252 at 293.
[84] *Generic Health Pty Ltd v Bayer Pharma Aktiengesellschaft* [2014] FCAFC 73; 314 ALR 91 at [71].
[85] *Nichia Corporation v Arrow Electronics Australia Pty Ltd* [2019] FCAFC 2 at [99].
[86] *Mylan Health Pty Ltd (formerly BGP Products Pty Ltd) v Sun Pharma ANZ Pty Ltd (formerly Ranbaxy Australia Pty Ltd* [2019] FCA 28 at [192], *Nichia Corporation v Arrow Electronics Australia Pty Ltd* [2019] FCAFC 2 at [91]-[93].
[87] DS at [4(b)].

D13: Wang *et al*., "A novel technique for microcrystalline graphite beneficiation based on alkali-acid leaching process", Separation Science and Technology, 2017, 53(6), 982-989
D14: Wang *et al*., "Insights into Alkali-Acid Leaching of Secrite: Dissolution behaviour and Mechanism", Minerals, 2017, 7, 196
D15: Thi *et al*., "Sulphuric Acid Leaching Process for Producing High Purity graphite from 92.6% C to 98% C", world Journal of Research and Review, 2017, 5(1), 23-26.

The problem to be solved

77. Dr Qiu was provided with each of documents D4 to D15 and asked the following problem:

> "Having regard only to what was known by you as at the Priority Date, what would you have been directly led to try if you were seeking to develop a purification method for graphite ore that is environmentally sustainable, non-toxic and provides a high purity graphite (in the order of 99.95%)?"[88]

78. Renascor relied on this problem in their submissions at hearing. I also note that after Dr Qiu provided evidence as to the steps he would have taken in response to the hypothetical question, he was then asked what (if anything) he would have done if the graphite had not reached the desired level of purity.[89] This subsequent question arguably directs Dr Qiu towards the use of combinations of different purification processes, rather than say replacement of the proposed solution (caustic bake) by a different process. However, given that his response included alternatives such as optimising the roast and leach steps I am satisfied that Dr Qiu considered the question more broadly than necessarily being limited to combinations.

79. The applicant submitted that the hypothetical questions put to Dr Qiu do not reflect the key issues, and therefore are not truly representative of the approach that the person skilled in the art would take at the priority date.[90] They argued that the application is directed to the cost effective, commercial purification of graphite to a level which makes it suitable for use as anodes in lithium batteries. Dr Qiu was not asked to consider practical issues such as the cost effectiveness, along with non-toxicity and sustainability. The applicant considered it clear from the evidence that Dr Qiu would have taken an entirely different approach if he had been asked to consider commercial issues such as cost-effectiveness, and referred to Dr Qiu's statement that *"[T]he technique of a caustic bake was very well known as at the Priority Date, but it was not commonly used in industry because of the associated cost"*.[91] Similarly, Dr Qiu stated that:*"*

> *"if I were developing a purification method with the aim of avoiding the use of HF (for environmental or safety reasons), I would use an alkaline bake or leach-type process, and that any alternative method to a HF acid leach process would necessarily be more complex and costly than the HF acid leach process. As at the Priority Date and today, the reason that the HF acid leach process is commonly used is because it is the most simple and cost-effective process."*

[88] Qiu 1 at [52].
[89] Qiu 1 at [58].
[90] AS at [185].
[91] Qiu 2 at [20].

80. On balance, I consider it appropriate to include cost-effectiveness in the problem. This is clearly indicated in the specification,[92] as well generally being a desirable feature in any graphite beneficiation process.[93] I therefore consider the problem can be articulated as being to a purification method for graphite ore that is cost-effective, environmentally sustainable, non-toxic, and provides a high purity graphite of greater than 99.95%.[94]

Obviousness in view of the common general knowledge alone

81. In response to the hypothetical problem outlined above, Dr Qiu stated that:

> "Having regard to the need to develop an environmentally sustainable and non-toxic method, I would have chosen an alkali-acid method. I would have chosen the alkali-acid method instead of a method using HF, because HF is more harmful to the environment than the alkali-acid method, as the wastewater from the alkali-acid method is easier to treat than the HF wastewater…"

82. The specific conditions Dr Qiu provided included the following consecutive steps:

- An alkaline roast using sodium hydroxide at a temperature of 400-600°C, for between 30 minutes and 2 hours. The sodium hydroxide would be used at about 20-40% of the weight of the graphite.
- A wash with water at a temperature above 50°C which would be continued until the mixture is neutral (i.e. pH of 7).
- An acid leach using a dilute acid such as hydrochloric or sulfuric acid at a temperature of 60-80°C for 2-6 hours.
- A hot water wash under the conditions used the previous wash.

83. When asked to outline the steps he would have taken if the graphite produced by the above process had not been purified to the desired level of 99.95%, Dr Qiu stated that:

> "… I would have repeated my alkali-acid method again to achieve a higher purity graphite product. I would have also tried changing the parameters which I used for both the alkaline roast and acid leach steps (including temperature, time and concentration of reagents), in order to optimise the process to obtain a higher purity graphite product. Based on my knowledge and experience in purifying graphite, I expect that conducting this process a second time would have resulted in an increase in the purity of the graphite product, such that following completion of the process the graphite would likely be in the order of around 99.95% or above."[95]

84. Renascor submitted that Dr Qiu's evidence demonstrates that the combination of features defined in Claim 1, *with the exception of the alkaline leach step*, is obvious in view of the common general knowledge.[96] My understanding of this submission is that Renascor does not consider that the combination defined in Claim 1, in its entirety, is obvious in view of the common general knowledge alone.

85. On the other hand, Dorfner submitted that in view of the evidence provided by each of the experts, it would be a matter of routine to use an alkaline bake-acid leach process to purify the graphite with the expectation of producing a high purity graphite material. This would

[92] Specification at page 2, lines 9 to 14.
[93] Qiu 1 at [50].
[94] I note the specification refers to carbon content of greater than 99.9%, but battery-grade SPG has a purity of greater than 99.95%. I understand that the present process is capable of obtaining battery-grade-SPG but is not limited to that application or level of purity.
[95] Qiu 1 at [58].
[96] RS at [88].

overcome the disadvantages associated with the use of HF. If further purification is required then the skilled person would turn their mind to considering what further purification might be undertaken. They submitted that the skilled person would readily know that a further purification could be conducted using an alkaline leach-acid leach process with the expectation that it might well remove further impurities from the graphite. The latter submission was based on the evidence of Dr Qiu who stated that:

> "It was common to combine multiple purification methods in order to improve graphite purity. In my research I have utilised combinations of the hybrid acid method, alkali-acid method and high temperature purification. For example, I have found that an alkaline roast step followed by leaching with HF, as well as the hybrid acid method followed by high temperature purification, can be used to obtain graphite of purity higher than 99.99%.
>
> It was also common to repeat the same purification step multiple times in order to improve graphite purity. For example, in my research I have found that repeating the hybrid acid method (i.e., carrying out two leach steps with HF) results in a substantial improvement in the final purity of graphite. However, I considered that certain purification steps were not suitable for repeating. For example, the alkaline roast step was more difficult to carry out multiple times because it was difficult to wash the sodium hydroxide from the graphite after an alkaline roast step. In contrast it was easy to wash acid from graphite after treatment with an acid."[97]

86. The applicant argued that *"the unsubstantiated reference to 'research' conducted by Dr Qiu that does not appear to have even been published (even assuming it took place before the Priority Date) does not establish that combining different methods had been assimilated into the CGK at the Priority Date. A fortiori, it does not establish that the combining of an alkaline roast with alkaline leach, with additional acid leaching steps, was either CGK or routine."* However, the applicant does not appear to dispute that the typical approach was to repeat the same purification steps to improve graphite purity, which they submitted is opposite to the approach used by the present invention.[98]

87. In any case, when asked to outline the steps he would have taken to develop a purification process, Dr Qiu arrived at a caustic roast-acid leach process. Even after being asked what additional steps he would have taken to improve the purity, Dr Qiu did not arrive at the combination defined by the present claims. Under the circumstances I do not consider that the evidence supports Dorfner's submissions that the present claims are obvious in view of the common general knowledge alone.

Obviousness in view of D13 and common general knowledge

88. D13 discloses an alkali leach graphite purification process comprising the steps of alkali leaching, water washing, acid leaching, water washing and drying. The alkali leaching process is performed at 150-270°C, which is said to be the common temperature used in the Bayer process for producing aluminium. Dr Qiu stated that he considered the process disclosed in D13 was a common process which he knew of at the priority date, and that it *"is the type of procedure which would have been included in textbooks used in the field of graphite purification"*, though there is no evidence that the process is in fact described in any textbook. D13 highlights the following disadvantages of alkali roast processes:

> "Alkali roasting-acid leaching process is usually employed to prepare high-purity graphite (carbon content ≥90%). In this process, graphite mixed with NaOH is roasted at 400-

[97] Qiu 1 at [46] to [47].
[98] AS at [180].

> 800°C in muffle. After roasting, the slag is washed by water and then leached by HCl solution. Silicate minerals in graphite dissolve into solution in form of silicate and aluminate. But two major disadvantages are found in our previous study and literatures. The first is that a portion of graphite oxidizes in the process of roasting. It causes unnecessary waste of graphite resource unless the roasting is proceeded under an inert atmosphere. The other is that it demands a lot of energy to dry wet flotation concentrate before alkali roasting.
>
> Thus, in order to develop a reasonable purification method to replace alkali roasting-acid leaching process and prepare microcrystalline graphite product with carbon content more than 90%, alkali-acid leaching process was employed to purify microcrystalline graphite concentrate in this work."[99] [references omitted]

89. As noted above, Dr Qiu stated that, if faced with the problem, he would have chosen an alkali roast-acid leach process. When asked what additional steps he would take if this process did not provide the desired level of purity, Dr Qiu stated that he would have repeated the alkali-acid process,[100] even though he also stated that the alkaline roast step was difficult to carry out multiple times because it was difficult to wash the sodium hydroxide from the graphite after the roast step.[101] He also agreed with the statement in D13 that it is convenient to avoid drying a wet graphite feed prior to subjecting it to a purification step.[102] Given this, he went on to state that:

> "another process that I would have been led to try in light of the [problem] would have been to conduct an alkaline leach-acid leach as the second process, following the initial alkaline roast-acid leach process. The benefit of this process is that after the first acid wash, it would not be necessary to dry the wet graphite product before the alkaline leach (which it would have been necessary to do if a second alkaline roast was conducted instead of an alkaline leach, which would have used a lot of energy as described in D13)"[103]

90. Dr Qiu acknowledged that the alkaline leach described in D13 requires the use of high pressure, and there are risks associated with such conditions, including the risk of explosions. He stated that he considered it possible to use lower temperature to avoid the use of high pressure, but significantly reducing the temperature would result in the reaction proceeding very slowly.[104] Given these constraints, he went on to state that:

> "I would not have been led by D13 to replace all the alkaline roast steps in my method to alkaline leach steps. Instead, I would have conducted the same alkaline roast-acid leach as I described… as the first process in my method. However, in light of D13, I would have been led to try an alkaline leach-acid leach as the second process in my method, which I would have used if the first alkaline roast-acid leach did not result in a graphite of sufficiently high purity. I would have expected this approach to be successful as I knew an alkaline leach-acid leach to be effective for removing impurities… and as I had previously found combining different purification methods to be effective for obtaining high purity graphite…"[105]

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[99] D13 at page 982, left column.
[100] Qiu 1 at [58].
[101] Qiu 1 at [47].
[102] Qiu 1 at [68].
[103] Qiu 1 at [69].
[104] Qiu 1 at [70].
[105] Qiu 1 at [71].

91. The applicant argued that Dr Qiu's complicated explanation as to why, despite the stated disadvantages, he would still use an alkali roast as well as an additional alkali leach, is illogical and implausible and does not reflect the approach that a reasonable person skilled in the art would take.[106] Mr Adamini noted that the process described in D13 was intended to be conducted *in place of* the caustic roast step in the known caustic roast-acid leach process. He went on to state that:

> "the pressurised leach of Wang 2 [D13] is a somewhat complicated process with hazards due to elevated pressure being required to maintain a liquid state at the elevated temperature. The Wang 2 process could be engineered to be safe but likely capital and operating costs would make it uneconomic."[107]

92. Similarly, Mr Frey stated that a pressurised process introduces safety hazards, capital and operating cost issues, and referred to the cost comparison between graphite purification processes set out in D2 at slide 21.[108] He also referred to data provided in D2 that showed a single treatment of graphite feedstocks with HF gave battery-grade graphite directly, whereas only three out of ten samples treated with a caustic bake or leach reached battery-grade directly. He stated that a graphite refiner would typically have selected an HF acid leaching process. Alternatively, if environmental or "green" considerations were a concern, an alternative would have been a thermal purification in which flake graphite is heated to above 2500-2800°C to vaporise impurities.[109]

93. Given the problem to be solved, and specifically the environmental concerns with the use of HF, I am satisfied that the person skilled in the art would be led to try alternatives in the manner described by Dr Qiu. The evidence suggests that relatively few alternative purification methods were available at the time, and that those that were available some disadvantages in their use. But obviousness does not require that there be only a single alternative, nor indeed that the alternatives do not possess any disadvantages.

94. I acknowledge that caustic processes were known to have some disadvantages in their use (such as loss of yield due to oxidation), and as a consequence their commercial use has been relatively limited compared to hybrid acid processes using HF. Nevertheless, based on the evidence before me I am satisfied that a caustic roast-acid leach process would have been an obvious alternative if seeking to use processes that employ non-toxic and environmentally sustainable reagents.[110] In doing so, the skilled person would recognise that caustic processes do not provide the same level of purity as hybrid acid methods and would require either variation of process parameters or additional purification steps.

95. I also acknowledge that the combination of an alkali roast-acid leach and an alkali-acid leach may suffer additional capital and operating costs, which in the context of the problem may impact on the cost-effectiveness of the process. However, I do not consider this would be a bar to the skilled person at least considering it worthwhile trying in the expectation that it would provide a higher level of purity. The problem to be solved has various aims – purity of the product, non-toxicity of reagents, environmental sustainability and cost-effectiveness. I do not think it necessarily follows that the invention must *entirely* meet each and every one of these aims. Rather it is a balance of these aims, or a matter of degree in the extent to which the solution meets those aims. Thus, for example, the reagents used in the present invention are not entirely benign, and there are hazards in the use of the caustic and acid reagents

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[106] AS at [234].
[107] Adamini at [39] to [40].
[108] Frey at [38].
[109] Frey at [39] to [41].
[110] Qiu 1 at [42].

employed in the present invention. Similarly, cost-effectiveness does not require that a solution be less expensive than the hybrid acid processes. Indeed, Mr Frey suggested that the skilled person would be led to use a thermal purification process if seeking an alternative, more environmentally sustainable process. The comparative cost of thermal purification is significantly higher than other processes,[111] but this does not appear to have been a factor in Dr Frey's consideration. It would seem to me that cost may be a consideration in the commercial implementation of a process, but the existence of such a deterrent would not, in itself, make an otherwise obvious process inventive.

96. I consider it reasonable that the skilled person would be led to try an additional purification step, and in view of D13 would arrive as a matter of course at the use of an alkali leach-acid leach, with the reasonable expectation that it would further improve the purity of the graphite in comparison with a caustic roast process alone. I am therefore satisfied that Claim 1 lacks an inventive step inasmuch as it relates to the caustic leach process disclosed in D13, and in particular, where the leach process is performed at elevated temperature and pressure. The specific conditions defined in Claims 2 to 16, and 20 to 25 are also either disclosed in D13 or would not require the skilled person to exercise any inventive faculty in their use, including the conditions used in the alkaline roast step,[112] the wash step following the caustic treatment,[113] the acid wash steps (including the second acid wash),[114] and the wash steps following the acid washes.[115]

97. However, I am not satisfied that the invention defined in Claims 17 to 19 is obvious based on the evidence before me. In particular, the NaOH leach defined by these claims is performed at "low temperature" (Claim 17),[116] and more specifically at 72°C to 88°C (Claim 18).

98. In his background discussion of caustic processes, Dr Qiu stated that it was possible to conduct an alkali leach at lower temperature to avoid the use of *high* pressure, but that *significantly* reducing the temperature would result in the reaction proceeding very slowly.[117] I do not understand Dr Qiu to mean that the leach process was used without elevated pressure, but rather without *high* pressure. That is also consistent with Dr Qiu's preference for using a caustic bake in preference to a caustic leach as high pressure was more difficult and dangerous to use than high temperature,[118] which indicates that alkali leach processes necessarily used elevated pressure.

99. However, after reading the present specification, and in particular the specific conditions set out at page 4 (and defined in Claims 17 to 19), Dr Qiu stated that:

> "I consider the 'NaOH leach' described in this passage is a known process, which I was aware of at the Priority Date but was not a common operation because at this concentration and temperature of the sodium hydroxide solution, I would expect the reaction between the sodium hydroxide and impurities to be very slow. However, this NaOH leach is being conducted after the initial alkaline bake and acid wash, which is why I understand the temperature used is lower and high pressure is not being used. That is, where there is a prior alkaline roast step I understand this would have removed the

[111] See D2, slide 21.
[112] Qiu 1 at [54].
[113] Qiu 1 at [55].
[114] Qiu 1 at [56].
[115] Qiu 1 at [57].
[116] The meaning of this term is discussed in detail under the ground of clarity. For the present purposes I have focused on the temperature defined in Claim 18.
[117] Qiu 1 at [70].
[118] Qiu 1 at [40].

> majority of impurities and I would expect a lower reactivity alkaline leach to be effective to remove small amounts of remaining impurities."[119]

100. Dr Qiu did not refer to any specific prior art in support of his statement that the "low reactivity" alkaline leach was a known process. Moreover, his statements that he would *expect* the reaction of sodium hydroxide and impurities in a low temperature alkali leach would be slow, and that the alkaline roast step would have removed the majority of impurities and therefore permit the use of a lower reactivity conditions appear to be based on an *ex post facto* analysis of the present invention rather than any specific disclosure or teaching in the prior art. As a consequence, I consider I can give this evidence little weight.

101. In short, there is no apparent teaching or suggestion in the prior art to use a "low temperature" alkaline leach and acid leach in combination with an alkali roast-acid leach process in order to obtain an environmentally sustainable and cost-effective process using non-toxic reagents to obtain graphite in the desired level of purity. To the contrary, the evidence teaches away from using significantly lower temperatures and milder conditions from those used in the prior art alkali leach processes such as D13. As indicated by Dr Qiu, the effectiveness of such mild conditions is only made possible by the previous alkali roast and acid wash steps. There is nothing in the evidence that I consider would suggest such a combination and the advantages it provides.

102. In summary, Claims 1 to 16 and 20 to 25 lack inventive step in view of D13. Claims 17 to 19 are inventive in view of D13.

Obviousness in view of each of D14 and D2 and common general knowledge

103. The disclosure given in D2 has been discussed in detail above under the ground of novelty. D14 is an article written by the same authors as D13. It describes a "more fundamental" study of the mechanism of reaction between an alkali leach and sericite, a typical impurity in graphite ore.[120]

104. The evidence provided in relation to these documents is much the same as that given in relation to D13, and I consider that I can deal with it fairly briefly. Both documents describe alkali leach-acid wash processes. D2 does not disclose the specific conditions used in the alkaline leach-acid wash process, but as I consider this process to be part of the common general knowledge, the conditions under which the process is performed would be known to the skilled person. For similar reasons to those set out above for D13, I consider that Claims 1 to 16 and 20 to 25 lack inventive step and Claims 17 to 19 are inventive in view of each of D2 and D14.

Obviousness in view of D1 and common general knowledge

105. D1 is discussed in detail above under the ground of novelty.

106. Renascor referred to the evidence of Dr Qiu who, when asked what he would have done in view of D1 and the problem, stated:

> "In light of D1, if I consider the [problem], I consider that I would have been led to try the process outlined in D1 and I expect it would result in a high purity graphite product (for the reasons I have outlined in paragraphs 114 to 120 above, and given the statement in the Abstract that the method results in graphite with a 'purity of more than 99.99%'). This process also omits HF so I consider it would be, for a graphite purification process, environmentally sustainable and non-toxic. While this process is more complex than

[119] Qiu 1 at [138].
[120] Qiu 1 at [72].

> performing an alkaline roast-acid leach process on its own (which would be my preference if I was seeking to keep costs of production low), it would not be difficult to perform the steps outlined in D1 as these are all standard techniques which are commonly performed (and were at the priority date)."[121]

107. Renascor submitted that the process described in D1 discloses all of the features of Claims 1, 7 and 20, and given that Dr Qiu would have been directly led to try the process of D1 if faced with the problem, it follows that these claims lack an inventive step.[122] In order to succeed, this argument requires a finding that all of the features of the present claims are disclosed by D1. As discussed above under the ground of novelty, I do not consider this is the case. Renascor's opposition on this point fails.

108. Dorfner submitted that the person skilled in the art would readily recognise that oxalic acid, as used in the acid wash step, was "unusual" and could be replaced by a straightforward, readily available and cost-effective acid such as sulfuric acid. They also noted that the roast temperature used in D1 is higher than that defined in the present claims. They submitted that the person skilled in the art would readily recognise that the temperature was higher than generally used in alkali roasts, and that a temperature of 400°C to 600°C could be adopted with an expectation of success.[123]

109. I do not find these submissions persuasive. As discussed previously, the process described in D1 comprises a "synergistic complexation" reaction where graphite is not entirely washed free of residual sodium hydroxide before the acid wash step. Residual sodium hydroxide reacts with oxalic acid to form oxalate species that complex metal ions in the graphite. Thus, the process described in D1 is aimed at the removal of specific impurities, namely metal ions, rather than the types of mineral impurities that are removed using caustic-acid wash processes. Sulfuric acid would not provide complexing species in the same way as oxalic acid, and indeed the evidence suggests that replacement of oxalic acid in this way could be detrimental under the conditions used in D1. For example, Dr Graf stated that if graphite is not washed well after caustic treatment, then impurities can precipitate in graphite when an acid is added.[124] On balance I do not consider that the skilled person would, based on the disclosure given in D1 and the intended purpose of the oxalic acid treatment, be led to replace oxalic acid by another acid such as sulfuric acid.

110. I therefore consider that the claims are inventive in view of the disclosure given in D1.

Obviousness in view of each of D4 to D12 and D15, and common general knowledge

111. I will deal summarily with the remaining documents raised in the opposition.

112. Renascor's submissions on these documents are based on Dr Qiu's response to the question of the steps that he would take in light of the information in these documents if faced with the problem. In short, Dr Qiu stated that he would adopt the same process that he described in response to the disclosure in D13. That is, the process he developed would not be changed by any of the additional information given in D4 to D12 and D15. Renascor argued that the fact that so much prior art "supports this process" is a powerful indicator of obviousness.

113. My understanding is that Dr Qiu did not consider that any of these documents added to the beneficiation process he developed in view of the common general knowledge and D13.

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[121] Qiu 1 at [121].
[122] RS at [100].
[123] DS at [120] to [122].
[124] Graf 2 at [5].

Given that they add nothing to the disclosure or steps that would be taken as a matter of routine, I do not consider these documents relevant to the obviousness determination.

Conclusion on inventive step

114. Claims 1 to 16 and 20 to 25 lack inventive step in view of D2, D13 and D14. Claims 17 to 19 are inventive in view of the prior art raised by the opponents.

Sufficiency

115. Section 40(2)(a) requires that a complete specification discloses the invention in a manner which is clear enough and complete enough for the invention to be performed by a person skilled in the art. The key consideration is whether, given the disclosure provided by the specification, the skilled person could perform the invention without undue burden or the need for further invention.[125]

Submissions

116. Renascor submitted that the specification does not provide clear enough and complete enough disclosure insofar as Claim 1 extends to use of any acid, use with any graphite material, production of graphite material of any purity, and includes methods beyond those exemplified in the first and second embodiments given in the specification.[126] In particular:

- The specification only discloses the use of sulfuric acid in the acid wash step. It is not plausible that the method of the invention would be effective using any possible acid, such as, for example a very weak acid.
- The specification only describes the manner in which the method can be applied to unpurified spherical purified graphite but Claim 1 applies to the purification of *all* graphite material.
- The specification states that the process can be applied to materials having much lower carbon content, such as black mass which has carbon content of 30 to 50%, to provide purity of greater than 99%. However, the embodiments only describe the purification of graphite having a starting carbon content in the order of 91[127] or 94%.[128]

117. Renascor concluded that, given the teaching given in the specification, the skilled person would not be able to perform the invention over the full scope of the claims without undue burden or the need for further invention.

118. Dorfner's submissions were similarly directed at the use of any acid and the purity of the product, in addition to the steps of neutralisation and washing. The submissions made by Dorfner on these points were largely framed in terms of the claims exceeding the technical contribution. Despite the applicant's submissions that Dorfner had conflated the grounds and their submissions should be entirely rejected on that basis,[129] I have considered them below. On the issue of the use of any acid in the acid leach step, Dorfner noted that sulfuric acid is the only acid identified in the specification. Moreover, the use of sulfuric acid overcomes the environmental problems associated with the prior art process using HF. They argued that the specification is insufficient because the invention cannot be practised to achieve the promised advantage of environmental sustainability.[130]

119. Dorfner also made submissions in relation to the purity of the starting materials used and the products obtained by the process of the invention. The submissions were essentially couched

[125] *Calix Ltd v Grenof Pty Ltd* [2023] FCA 278; 171 IPR 528 at [118].
[126] RS at [108] to [112].
[127] Qiu 1 at [153].
[128] Frey at [87].
[129] As at [252].
[130] DS at [145] to [148].

in terms of support rather than sufficiency but given that they relate to similar issues raised by Renascor, it is convenient to deal with them here. In particular, Dorfner submitted that the advantage of the alleged invention is said to lie in the provision of a cost-effective and environmentally sustainable method of producing purified graphite with carbon content greater than 99.9%.[131] The preferred embodiment indicates that after the first stage (caustic bake-acid leach), the purity is 99.96%, and the second stage (caustic-acid leach) improves this by only 0.02%. The specification states that the alleged invention is *capable* of achieving a purity of 99.95%.[132] The alleged invention, if it is to be inventive, resides in the ability to achieve purity of greater than 99.95%, noting that this level is achieved using the prior art caustic bake-acid leach process.

120. The applicant asserted that there were a number of difficulties with the approaches taken by the opponents. Firstly, Dr Qiu did not state in his evidence that the disclosure was such that he was unable to perform the claimed invention, or that the skilled person would have any difficulty in working the invention. As to the acid, they noted that Renascor had acknowledged[133] that other acids, including hydrochloric, sulfuric and nitric acids, could be used, and as such there was no basis to limit the claims on the basis that the preferments refer only to sulfuric acid.[134]

121. In relation to the purity of the starting material and final product, they submitted that it was well known to use flotation to increase the final or total graphitic carbon content of the graphite concentrate to between 90 to 98%. They argued that there is no basis to assert that the skilled person would not be able to perform the invention unless the starting purity was limited to that of the preferred embodiments.[135]

122. Finally, the applicant submitted that the opponents' submissions must be considered in the context of their own evidence. To that end they stated that the underlying basis of the opponents' various propositions is that the art is so complex, difficult and unpredictable that, notwithstanding the clear and very detailed description of the methodology employed, the skilled person would be unable to perform the invention. This stands in stark contrast to the assertions as to the common general knowledge of the skilled person and the modifications that they would make to the various prior art relied on under the grounds of inventive step. The applicant concluded that the skilled person would have no difficulty reproducing the method described in the application based on the information provided in the specification, including the examples.[136] On this particular point, I note that a tension in the submissions made by parties is not unusual in opposition proceedings. These are simply issues that are taken into account in the consideration of the evidence as a whole.

Determination

123. In relation to the acid used in the process, I agree the term acid is a broad term that, at least at first blush, would encompass any type of acid under any conditions and concentration. However, it does not necessarily follow that the claim is insufficient. As stated by Birss J after a consideration of the UK authorities in relation to sufficiency:

> "When examining enablement of any kind, the test is always about what the skilled person is able to do without undue burden. The patentee is entitled to expect that the skilled

[131] Specification at page 2, lines 9 to 11.
[132] Specification at page 13, line 25.
[133] RS at [42].
[134] AS at [249] to [250].
[135] AS at [251].
[136] AS at [253] to [256].

> person, in seeking to make the invention work, will exercise that skill. If need be that exercise will involve testing and experiments, as long as it is not unduly burdensome."[137]

124. Admittedly, very "weak" acids (presumably those that do not dissociate well in solution, or that are used in low concentrations) may not be effective in the acid wash step, and there is little direction given as to acids that may be suitable for this purpose. But as highlighted by the applicant, the opponents' submissions in relation to obviousness are predicated on the common general knowledge including "known" alkali-acid processes (roast or leach) which comprise an acid wash step. That being the case, it would seem to me that the skilled person, in seeking to make the invention work, would be guided to use suitable acids under appropriate conditions without an undue burden of experimentation.

125. In any case, the opponents have adduced no evidence that would establish that any particular acid would not work, nor that it would be an undue burden of experimentation to determine suitable acids for the purpose. To that end, Dr Qiu's evidence related to the use of HF, and whether it would deliver the desired outcomes of a more cost-effective, non-toxic and environmentally sustainable purification process.[138] He does not suggest that the specification is not clear enough and complete enough for the skilled person to work the invention, nor even that HF would not work in the process of the invention. Moreover, while the use of HF in the present process might not entirely avoid its use, the evidence does not specifically address whether this would be more cost-effective, non-toxic and environmentally sustainable than the hybrid acid process. To the extent that this is a relevant consideration under the ground of sufficiency (rather than say utility), I am not satisfied that the opponents have made their case on this point.

126. Turning to the issue of the graphite starting material, my understanding is that the opponents are not disputing that the process can be used to prepare battery-grade SPG, which requires a purity of at least 99.95%.[139] To this end, the manufacture of spherical graphite involves the micronisation and rounding of flake graphite,[140] as well an initial purification step (such as flotation), that provides a starting SPG material with a purity of about 94%.[141] Dr Qiu stated that, based on his experience, he would expect that the process outlined in the application could be used to purify graphite ore for use in batteries.[142]

127. However, the specification states that the invention *relates particularly, though not exclusively*,[143] to such a process for producing battery-grade SPG. The invention is said to be "*capable of achieving a purity of 99.95%C and above*",[144] and that:

> "The present invention was developed with a view to providing a cost effective and environmentally sustainable method of producing purified graphite with carbon content higher than 99.9%. Although the present invention is described with particular reference to producing battery-grade SPG it will be understood that the method of producing purified graphite may also have wider applications."[145]

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[137] *Illumina Cambridge Ltd v Latvia MGI Tech SIA* [2021] EWHC 57 (Pat); RPC 12 at [279].
[138] Qiu 1 at [169].
[139] Qiu 1 at [25].
[140] Specification at page
[141] Qiu 1 at [132].
[142] Qiu 1 at [132].
[143] Specification at page 1, lines 3 to 5.
[144] Specification at page 13, lines 24 to 26.
[145] Specification at page 2, lines 9 to 14.

128. The specification goes on to state that the process of the invention can be used with flake graphite, or for purifying black mass,[146] the residue remaining after hydrometallurgical processes that recover valuable metals from batteries.

129. The opponents' submissions under this ground are essentially that the claims should be limited to the specific examples described in the present application. I see no basis for such a limitation. The invention is said to be *capable* of obtaining purity of greater than 99.95%, I do not understand this to mean that the invention to be limited to the preparation of battery-grade SPG, but rather that it is able, if applied to an appropriate starting material, to provide that level of purity. There is nothing in evidence that would establish that the present process could not be applied to graphite materials having a lesser purity, or that it would require an undue burden of experimentation to do so. To the contrary, Dr Qiu stated that, in general, the purity of a product is dependent on the purity of the starting material, and that he did not expect that graphite with a purity of 99.95% would be obtained from a starting material of purity lower than 92%.[147] Thus a starting material of appropriate purity would be used if seeking a higher purity product.

130. Dr Qiu went on to state that the process of the invention would likely be more effective at purifying spherical graphite than, say, flake graphite, because of its smaller particle size.[148] Even here, I do not understand Dr Qiu to be stating that there would be any difficulties in applying the present process to the purification of flake graphite, but rather the process would be less effective. Moreover, Dr Frey stated that flake graphite and spherical graphite contain almost identical impurities.[149] It would seem plausible that the present process would therefore be suitable for use with flake graphite.

131. I consider it less plausible that the invention can be used for the purification of black mass. Mr Frey also stated that the process of the invention could be used to remove metallic impurities from black mass as the second phase of the process,[150] but questioned whether the term "graphite material" even included black mass.

132. Assuming the scope of the claims extends to the purification of black mass, I consider that the specification is insufficient. The nature of the impurities in the starting material appears to be a key factor in the selection of a purification method. For example, Dr Qiu stated that alkali-acid methods would be most effective purification method for graphite ores having higher mica content.[151] In contrast, black mass usually consists of a mixture of carbon, lithium, manganese, cobalt and nickel, as well as anode material which consists of natural battery graphite, synthetic graphite and silicon.[152] Dr Qiu stated that:

> "… I would not expect that the same process could also be used to treat graphite from recycled batteries, because the graphite which is used in batteries has very different properties and impurities from graphite ore… Chemicals used for the purification of natural graphite ores are selected to react with naturally occurring impurities, in particular silicates and aluminates. I would not expect these chemicals to necessarily be effective for removing the impurities found in black mass, as they are chemically distinct from naturally occurring impurities. In addition, due to the charging and discharging of the

[146] Specification at page 13, lines 12 to 19.
[147] Qiu 1 at [154].
[148] Qui 1 at [161].
[149] Frey at [97].
[150] Frey at [79].
[151] Qiu 1 at [45].
[152] Specification at page 2, lines 1 to 8.

batteries, the graphite experiences an expansion process and if you recover it from the used battery, it may not be possible to use it in new batteries."[153]

133. Dr Qiu went on to note that the specification described an increase in purity from "30-50% carbon to +99% carbon using black mass. He did not consider the methods described in the specification would achieve such an improvement because the impurities are more complex and different from those contained in flake graphite and SPG.[154]

134. I find the opponent's submissions on this point to be persuasive. The various caustic and acid treatments are directed at those specific silicon and aluminium impurities. There is no apparent basis to conclude that the present process, which is suited for the purification of graphite ores containing such impurities could, based on the information provided in the specification, be applied to black mass. Based on the evidence before me, this would require an undue burden of experimentation to determine the specific conditions required for the purification of such a different graphite material.

135. In short, I consider there is a clear enough and complete enough disclosure in relation to the types of acids used in the acid wash, the purity of the starting materials, and the use of SPG and flake graphite in the process. However, I do not consider that the specification provides a clear enough and complete enough disclosure beyond the use of flake and spheroidal graphite, such as the purification of black mass.

Support

136. Section 40(3) of the Act requires that the claims must be supported by matter disclosed in the specification. The Federal Court[155] has adopted the test set out by Aldous J in *Schering Biotech Corp's Application*:

> "... to decide whether the claims are supported by the description it is necessary to ascertain what is the invention which is specified in the claims and then compare that with the invention which has been described in the specification. Thereafter the court's task is to decide whether the invention in the claims is supported by the description. I do not believe that the mere mention in the specification of features appearing in the claim will necessarily be a sufficient support. The word "support" means more than that and requires the description to be the base which can fairly entitle the patentee to a monopoly of the width claimed ..."[156]

137. Renascor made several similar submissions under the ground of support as they made in relation to the type of graphite material used in the process (and the fact that the claims define the use of all natural, synthetic and recycled graphite), and the types of acids used in the acid wash. They also expanded on the issue of the acids, submitting that the claims do not exclude the use of HF, which they noted was inconsistent with the specification (which only discloses the use of sulfuric acid), and the aim of providing a more cost-effective, non-toxic and environmentally sustainable process for the purification of graphite.[157] Dorfner made similar submissions on these points.[158]

138. I consider that the issues raised by the opponents on these points substantially overlap with those dealt with under the ground of sufficiency. I do not consider that a consideration under the ground of support would reach a different outcome. In short, I consider that the claims are

[153] Qiu 1 at [130].
[154] Qiu 1 at [161].
[155] See, for example, *Calix Limited v Grenof Pty Ltd* [2023] FCA 378 at [126] to [128].
[156] [1993] RPC 249 at [252] to [253].
[157] RS at [116] to [120].
[158] DS at [136] to [148].

supported in relation to the purity of the graphite material and the use of flake and spheroidal graphite in the process, and the types of acid used in the acid wash step. However, for similar reasons to those given above, I do not consider the claims are supported in relation to the use of the present process for the purification of other types of graphite materials, including black mass.

139. Dorfner further submitted that the present claims include situations where there might be separate neutralisation and washing steps, but there is no disclosure of such separate steps in the specification.[159] My understanding is that this relates to the definition in claim 1 of a step of neutralising and washing the acid washed graphite material following the first and second acid wash steps. I do not consider this a significant issue, and certainly not one that results in the claims exceeding the technical contribution of the invention. As stated by Dr Qiu, in alkali-acid processes:

> "… it was typical to remove solubilised impurities by washing with water. That is, after each step in which the graphite was treated with alkali or acid, it was standard practice to wash the graphite until the washing solution had reached about pH 7. Typical conditions for the water washing step were to wash with water three to four times, the water having a temperature of 50°C or more."[160]

140. Thus, the typical acid wash step is followed by a washing step in which the graphite material is washed to neutral. The discussion of the neutralising and washing step in the present specification is consistent with the prior art methods, and I consider the claim would be read as such. Indeed, Dr Qiu referred to the steps of the present process as being "*routine and standard steps that are necessary to include in all types of alkali-acid treatments, as it is always necessary to wash with water following the alkali and acid steps*".

141. In summary, the claims are not supported in respect of the use of the process for the purification of black mass. However, none of the other issues raised by the opponents have been made out.

Clarity

142. Section 40(3) of the Act requires that the claim or claims must be clear and succinct. A claim will lack clarity if a third party would be unable to ascertain whether an act would fall within the scope of the claim.[161]

143. The opponents made submissions on a number of terms used in the claims. I have grouped these according to the type of issue involved. The first of these relates primarily to the meaning of "technical" terms:

- *Graphite material* (Claims 1 to 25): as an alternative to the submissions made under the grounds of sufficiency and support, the term "graphite material" is unclear as to whether all the different forms of graphite can be purified by the method of the invention, or whether the claims are directed to a particular type of graphite.
- *Diluted acid mixture comprising water and H_2SO_4* (Claim 9): it is unclear whether this definition includes mixtures of water, sulfuric acid and *other* acids.
- *Liquid NaOH (50%)* (Claim 2): the claim does not specify whether the concentration is by weight or by volume.
- *Parts* (Claims 8, 10, 11, 15, 16, 17, 23 and 24): it is unclear whether the reference to parts in these claims is intended to be by volume or by weight.

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[159] DS at [149].
[160] Qiu 1 at [43].
[161] *Monsanto Co v Commissioner of Patents* (1974) 48 ALJR 59.

144. On the first of these issues, the evidence suggests that it is unclear whether black mass is a graphite material. Despite the specification indicating that the invention may be used for the purification of black mass,[162] Mr Frey did not consider black mass to be a graphite material because of the types of impurities present.[163] There is no general definition provided for the term "graphite material", and no clear distinction made in the specification, or in the evidence, as to the types of materials (and impurities) that would be considered to fall within the scope of the term "graphite material" and those that would not. Under the circumstances, I therefore consider that the claims as a whole lack clarity as to the scope of the term graphite material.

145. On the second issue, I understand the claim to be directed to a dilute solution of sulfuric acid, but given use of the open-ended term *comprising*, the scope of the claim would extend to solutions comprising other components. Furthermore, the claim defines that solution is a dilute acid, so at the very least is limited to such solutions. While other components are not explicitly defined, I do not consider that this results in a lack of clarity.

146. I consider the third and fourth points are similar considerations. My understanding is that the "liquid" NaOH is a 50% solution of sodium hydroxide, and the concentration in such cases is a w/v measure.[164] In the case of the references to *parts*, Dr Qiu stated that mass was generally used when measuring amounts of reagents and graphite,[165] and this does not appear to have been disputed in evidence. I am satisfied that the claims would be read as referring to a weight-to-weight measure.

147. The second group of issues relates to the use of "indefinite" terms. In particular, the opponents submitted that the terms *approximately* (Claims 4, 12, 24 and 25) and *about* (Claims 8, 13 and 19) resulted in the precise bounds of the claims being unclear. The applicant noted that the use of terms expressing approximation or requiring assessment according to circumstances does not necessarily mean that a claim using those terms lacks clarity.[166]

148. As an initial point, I note that none of the experts appear to have had any difficulty determining the meaning of the claims. For example, Dr Qiu stated that:

> "The time range described for the alkaline bake in this claim is very typical, and I consider it was well known… that a period of 25 to 45 minutes could be used for the alkaline bake (or a longer time could be used, for example in the order of an hour or more)."[167]

149. In any case, as noted by the applicant, lack of precise definition in claims is not fatal to their validity so long as they provide a workable standard suitable to the intended use,[168] and it is permissible to use an imprecise word in a claim where, in an appropriate context, it conveys the necessary meaning.[169] In the present case, the terms are used in relation to the time and temperature for which process steps are performed. It would seem to me that the nature of such processes would inherently involve a degree of imprecision of the nature indicated in the claims. I do not consider the claims lack clarity on this basis.

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[162] Specification at page 13, lines 12 to 19.
[163] Frey at [79] to [80].
[164] Qiu 1 at [135].
[165] Qiu 1 at [146].
[166] *Stena Rederi Aktiebolag v Austal Ships Sales Pty Ltd* [2007] FCA 864 at [21].
[167] Qiu 1 at [176].
[168] *Minnesota Mining & Manufacturing C. v Beiersdorf (Australia) Ltd, supra* at 274.
[169] *Leonardis v Sartas No 1 Pty Ltd* (1996) 67 FCR 126 at 134.

150. The third group of submissions generally involved the use of relative terms in the claims. The opponents submitted that no information was provided as to what the particular definitions include:

- *Elevated temperatures* (Claim 14): No information is provided as to what temperature constitutes an "elevated" temperature.
- *Low temperature* (Claim 17): No information is provided as to what temperature would constitute a low temperature.
- *Hot water* (Claim 6): No information is given as to the temperature at which water would be considered hot such that the precise boundaries of the claim are not discernible.

151. The applicant noted that relative expressions which require the exercise of judgement can be used but they must be understood in a practical commonsense manner.[170] In the case of the terms "elevated temperature" and "hot water", I am satisfied that the skilled person would be able to give the terms meaning. For example, despite stating that the reference to "elevated temperatures is "ambiguous" because it is not clear what the lower and higher end of the range of elevated temperatures would be, Dr Qiu stated that:

> "However, as I explained in relation to claim 6 above, it was common to before the Priority Date for washing processes to be conducted using hot water, to assist with releasing the reagents form the product, such that I consider the process described in claim 14 to be a common process which was well-known at the priority date."[171]

152. Thus, while the claims do not give a specific definition of the terms 'elevated" or "hot", I understand them to mean that the wash steps are done using water at a temperature higher than room temperature. I consider that they would select a temperature appropriate for such a step, and given Dr Qiu's statement suggesting that these were commonly used processes, they would be readily able to determine such temperatures. I do not consider the claims lack clarity on this basis.

153. On the other hand, I am not satisfied that the term "low temperature" can be clarified in the same manner. The scope of the term is not clearly defined in the specification or claims. Dr Qiu stated that:

> "Claim 17 describes an alkaline leach process, which as I described in paragraph 39 above, was a commonly used chemical purification process which was well-known as at the Priority Date. In my experience, when conducting an alkaline leach as the first step in a purification step it was common for it to be conducted at low temperature (relative to a sodium hydroxide bake) but under higher pressure (typically around 160-180°C at 0.6-1.0 MPa) in order to achieve sufficient reactivity of sodium hydroxide…"[172]

154. Notably Dr Qiu refers to the term "low" with reference to the temperature at which a sodium hydroxide bake is carried out (typically 400-600°C). However, Dr Qiu went on to state that:

> "The term 'low temperature' is ambiguous, as it does not indicate the lower or upper range of temperatures which should be used. However, given that claim 18 refers to a range of 72°C to 88°C, I assume that the 'low temperature' in claim 17 must be around those temperatures"[173]

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[170] *Stena Rederi Aktiebolag v Austal Ships Sales Pty Ltd, supra* at [22].
[171] Qiu 1 at [197].
[172] Qiu 1 at [203].
[173] Qiu 1 at [205].

155. Mr Frey did not directly address the meaning of the term "low temperature" but stated that pressure leaching at increased pressure and temperature, is disadvantageous. He stated that the present process was not directed at a conventional alkaline leaching process.[174] I understand this to mean that the present invention is distinguished from the prior art by the temperature at which the caustic leach is performed.

156. Given the evidence before me, I am not satisfied that a skilled person would be able to determine with any certainty, whether an act they were doing fell within the scope of the claims. In particular, the term "low temperature" would have an accepted meaning in the art, being in line with the conventional conditions used for alkaline leach processes, and with reference to high temperature alkaline bakes. Thus, low temperature processes, as used in the art, are performed in the temperature range of 160°C to 180°C. However, the present "low temperature" leach uses even lower temperatures than those used in conventional leaches. Furthermore, while the specification and claims refer to a temperature range of 72°C to 88°C, there is no basis for limiting the term "low temperature" in the claim to this specific range. In short, I consider that Claim 17 is not clear in meaning as to the temperature range under which the process is performed.

157. Finally, the opponents submitted that Claim 20 lacked clarity as the intermediate graphite product is "preferably" neutralised and washed before it is subject to the acid wash step. My understanding of the opponent's submissions is that the term "preferably" results in the neutralisation and washing steps being optional (or inessential) and therefore being no different in scope to Claim 1. That is, Claim 20 is redundant on Claim 1.

158. I do not consider this a significant issue that results in the claim lacking clarity. None of the experts appeared to have any difficulties with understanding the meaning of Claim 20. Thus, for example, Dr Qiu stated that he understood the second step of washing to neutral to be a separate step to the "releasing any remaining NaOH" step.[175]

159. In summary, I consider claims 1 to 25 lack clarity in respect of the term "graphite material" and Claim 17 lacks clarity in respect of the term "low temperature". The opposition has not been made out in respect of the other issues raised by the opponents under this ground.

Manner of manufacture

160. Section 18(1)(a) of the Act requires that the invention, so far as claimed in any claim, must be a manner of manufacture within the meaning of section 6 of the Statute of Monopolies.

161. Dorfner submitted that the claims are in substance and in form, nothing more than performing known purification processes one after another. They have no working interrelationship, and it was known that multiple processes might be performed on the one body of impure graphite.[176] In support of their arguments, the opponent referred me to the classic formulation given in *British Celanese Ltd v Courtaulds Ltd* as follows:

> "It is accepted as sound law that the mere placing side by side of old integers so that each performs its own proper function independently of the others is not a patentable combination, but where the old integers when placed together have some working interrelationship producing a new or improved result is patentable subject in the idea of working brought about by the collocation of integers."[177]

[174] Frey at [114] to [115].
[175] Qiu 2 at [47].
[176] DS at [155].
[177] [1935] 52 RPC 171 at 194.

162. The applicant submitted that the claimed process is one which includes numerous ordered steps, each of which produces the material for the next step. They argued that it cannot be said not to define a working interrelationship between component integers.

163. On balance I agree with the applicant on this point. Even if I accept Dorfner's submission that the present (multistep) process is a collocation of two "known" purification processes, I do not consider that there is no working interrelationship between the steps. The alkaline leach and acid wash steps increase the level of purity of the final graphite product. This may be a relatively small amount, but my understanding of the evidence is that for certain applications even a small increase in purity can be beneficial. I do not consider that the opponent has made out their case on this point.

Conclusion

164. The oppositions are successful.

165. Claims 1 to 16 and 20 to 25 lack inventive step in view of D2, D13 and D14. However, Claims 17 to 19 are inventive in view of the prior art raised by the opponents.

166. The specification does not provide a clear enough and complete enough disclosure beyond the use of spheroidal and flake graphite in the process of the invention. However, the oppositions are unsuccessful in respect to other issues raised by the opponents under the ground of section 40(2)(a).

167. Claims 1 to 25 are not supported in respect to the use of the process for the purification of graphite materials other than flake and spheroidal graphite. Claims 1 to 25 are not clear as the term "graphite material" is unclear in scope. Claim 17 lacks clarity due to the term "low temperature". None of the other issues raised by the opponents under section 40(3) have been made out.

168. The claims are novel. The oppositions are unsuccessful on this ground.

169. The claims are for a manner of manufacture. The Dorfner opposition is unsuccessful on this ground.

170. I consider that the specification contains patentable subject matter. I therefore give the applicant two (2) months from the date of this decision to file amendments to overcome the deficiencies.

Costs

171. Costs generally follow the event. I see no reason to depart from that approach.

172. The oppositions have each been successful on at least one ground. I therefore award costs according to Schedule 8 in each opposition against the applicant, EcoGraf Ltd.

Dr Leslie. F. McCaffery
Delegate of the Commissioner of Patents

Annex: Claims

1. A method of producing purified graphite, the method comprising the steps of:
subjecting graphite material to a sodium hydroxide (NaOH) bake;
releasing any remaining NaOH using water;
subjecting the graphite material to a first acid wash;
neutralising and washing the acid washed graphite material to deliver an intermediate purified graphite product;
subjecting the intermediate purified graphite product to a NaOH leach;
releasing any remaining NaOH in the intermediate purified graphite product using water;
subjecting the intermediate purified graphite product to an acid wash; and,
neutralising and washing the intermediate purified graphite product to deliver a final purified graphite product.

2. A method of producing purified graphite as defined in claim 1, wherein the step of subjecting the graphite material to a NaOH bake comprises mixing the graphite material with liquid NaOH (50%) and heating the mixture in a furnace.

3. A method of producing purified graphite as defined in claim 2, wherein the mixture is heated to a temperature of between 450°C and 550° C.

4. A method of producing purified graphite as defined in claim 3, wherein the mixture is heated for between approximately 25 to 45 minutes.

5. A method of producing purified graphite as defined in claim 4, wherein the mixture is heated to 500° C for 30 minutes.

6. A method of producing purified graphite as defined in claim 1, wherein the step of releasing any remaining NaOH comprises immersing the material in hot water.

7. A method of producing purified graphite as defined in claim 1, wherein, after the step of releasing any remaining NaOH, the material is washed and filtered.

8. A method of producing purified graphite as defined in claim 7, wherein the material is washed and filtered in a wash neutral step at ambient temperature, for about 5 to 10 minutes, using 2.0 to 7.0 parts H2O.

9. A method of producing purified graphite as defined in claim 1, wherein the step of subjecting the material to a first acid wash comprises washing the material with a diluted acid mixture comprising water and H2SO4.

10. A method of producing purified graphite as defined in claim 9, wherein the diluted acid mixture comprises between 2.0 to 5.0 parts H2O and between 0.15 and 0.25 parts H2SO4 96%.

11. A method of producing purified graphite as defined in claim 10, wherein the diluted acid mixture comprises 4.0 parts H2O and 0.17 parts H2SO4 96%.

12. A method of producing purified graphite as defined in any one of claims 9 to 11, wherein the first acid wash is performed at elevated temperatures in the range of approximately 70° C to 90° C to increase reactivity.

13. A method of producing purified graphite as defined in claim 12, wherein the first acid wash is performed at an elevated temperature of 80° C for between about 25 to 45 minutes.

14. A method of producing purified graphite as defined in claim 1, wherein the step of neutralising and washing the acid washed graphite material comprises filtering the material at ambient temperature and final washing with water at elevated temperatures respectively.

15. A method of producing purified graphite as defined in claim 14, wherein the final washing with water occurs at 85° C for 30 minutes using 20 parts H2O.

16. A method of producing purified graphite as defined in claim 1, wherein the step of neutralising and washing the material comprises washing the acid washed graphite material in 3 to 7 parts H2O for 3 to 7 minutes while stirring, at ambient temperature.

17. A method of producing purified graphite as defined in claim 1, wherein the step of subjecting the intermediate purified graphite product to a NaOH leach comprises immersing the intermediate purified graphite product in 0.1 to 0.3 parts NaOH (50%) with 2.0 to 4.0 parts H2O at low temperature.

18. A method of producing purified graphite as defined in claim 17, wherein the NaOH leach takes place at temperatures in the range of 72°C to 88°C.

19. A method of producing purified graphite as defined in claim 18, wherein the residence time for the NaOH leach is about 1.5 to 2.5 hours.

20. A method of producing purified graphite as defined in claim 1, wherein the intermediate purified graphite product is preferably neutralized and washed, before it is subject to the acid wash step.

21. A method of producing purified graphite as defined in any one of claims 16 to 20, wherein the only reagents used are NaOH in the NaOH bake and NaOH leach steps, and H2SO4 in the acid wash steps.

22. A method of producing purified graphite as defined in claim 21, wherein, the intermediate purified graphite product is finally washed in a water bath and neutralized with water after the acid wash step.

23. A method of producing purified graphite as defined in claim 1, wherein the acid wash of the intermediate purified graphite product is performed with a diluted acid mixture comprising between 2.0 and 4.0 parts H2O and 0.01 to 0.04 parts H2SO4 96%.

24. A method of producing purified graphite as defined in claim 23, wherein the diluted acid mixture comprises 2.5 parts H2O and 0.03 parts H2SO4 96%, and the acid wash is performed at elevated temperatures in the range of approximately 77° C to 93° C to increase reactivity.

25. A method of producing purified graphite as defined in claim 24, wherein, the acid wash is performed at an elevated temperature of 80°C for approximately 35 minutes.

Attachment B

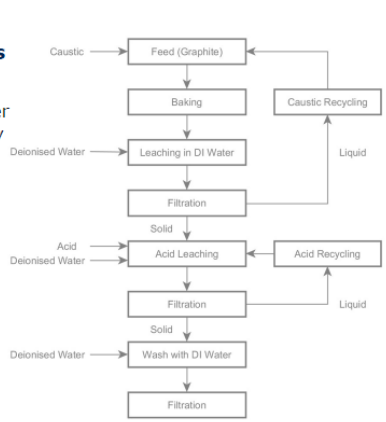
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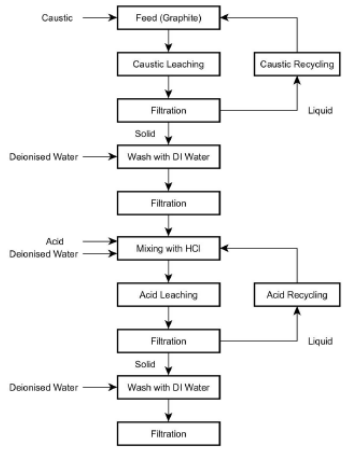
Graphite Purification

Caustic Treatment Technologies

Applying a multistep sequence at lower temperature but increasing complexity of the overall process

- Caustic Leach (right)
  - Fluorine free
  - Increasing complexity
  - Moderate temperature
- Tailored to impurities
- Combinations possible





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