

OPINION UNDER SECTION 74A

Patent	EP 2356191 B1
Proprietor(s)	Diamond Innovations Inc
Exclusive Licensee	
Requester	Carpmaels & Ransford LLP
Observer(s)	Murgitroyd & Company (on behalf of the Proprietor)
Date Opinion issued	05 January 2022

The Request

1. The Comptroller has been requested by Carpmaels & Ransford LLP ("the Requester") to issue an opinion as to whether EP 2356191 B1 ("the Patent") is invalid on the grounds of a lack of inventive step. The request was filed on 08 October 2021 and was accompanied by a statement explaining the request. The statement referred to two documents D5: US 5035771 A and D6: US4435189 A.
2. More specifically, the request relates to whether independent method claim 9 and claims dependent thereon are inventive over the teaching of D5 in view of the common general knowledge ("CGK"), of which D6 was provided as evidence. The Requester asserts that, as the product of claims 1 to 8 are inevitably derived from the method claims 9 to 13, then, should the method claims be deemed to lack an inventive step, the product claims would also be obvious.

Observations and Observations in Reply

3. Observations were received from Murgitroyd & Company ("the Observer") on behalf of Diamond Innovations Inc ("the Proprietor") on 09 November 2021 and observations in reply were received from the Requester on 24 November 2021.

Allowance of the Request

4. The Office will not issue an Opinion if the question upon which the Opinion is sought appears to have been sufficiently considered in any relevant proceedings by virtue of Section 74A(3)(b) of the Patents Act 1977 ("the Act") and/or Rule 94(1)(b) of The Patents Rules 2007. This provision allows requests to be refused which do no more than repeat arguments already considered pre-grant.

5. The Observer asserts that the Comptroller should refuse the request under Rule 94(1)(b) on the basis that D6 "is not accurate and appropriate 'evidence' of the CGK, in part, due to the substantial differences in the technological focus of D6 relative to the patent".
6. In their observations in reply, the Requester asserts that the argument combining the CGK (as evidenced by D6) and D5 was never raised pre-grant and so has not been considered. The Requester also explained further why they believe D6 should be considered CGK and listed additional documents that they consider demonstrate the CGK (US3556839, US5190796, US5250086A, GB1236779, US3924031, GB1310324A, US4062660 and Kirk-Othmer, Encyclopaedia of Chemical Technology).
7. The Opinion process involves three rounds of submissions - the request, observations and observations in reply. The process does not afford the Proprietor the opportunity to comment on the observations in reply. A strict approach to observations in reply must therefore be taken and, as these additional documents constitute new evidence, they will not be considered in my Opinion.
8. D5 was considered by the Examiner (see the EPO's communication of 28 February 2019). In this correspondence, the Examiner stated when considering D5 "None of the prior art mention or suggest to coat the provided monocrystalline diamond particles with a reactive metal coating instead of embedding them in a metal powder in order to increase the abrasive properties of the etched particles to be obtained". Therefore, although the Examiner has considered the inventiveness of the claim, they do not appear to have considered it on the basis that coating diamond particles with a reactive metal coating is part of the skilled person's CGK. The request is made on the basis that D6 is evidence of such CGK. I consider the request to be a new question, albeit I must decide whether D6 is indeed evidence of the CGK as argued by the Requester.

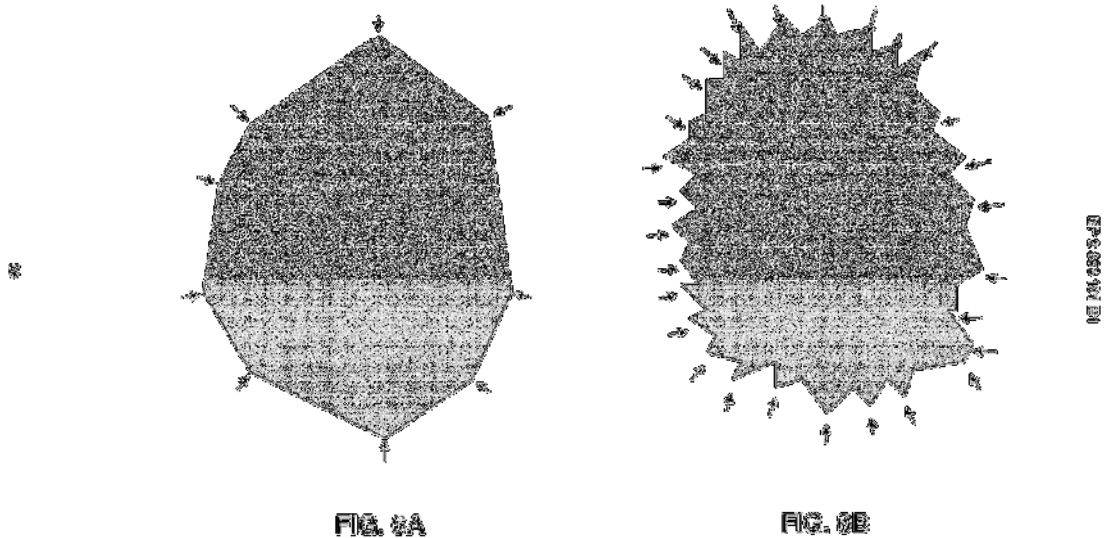
Scope of the Opinion

9. The Requester states in their final comments that the teaching of paragraph [0033] of the Patent appears to suggest that embedding diamond grit in powder would produce similar, or even the same, results to coating the grit. This would seem to be a further attack on the inventiveness, or even the novelty, of the product of the Patent in view of the teaching of D5. As this question has already been addressed pre-grant, it will not be considered in my Opinion.
10. As indicated in the Office's correspondence dated 13 October 2021, in the absence of any data or evidence regarding the physical properties of a diamond particle made in the way suggested, it is unlikely that I will be able to reach a conclusion that the Patent is invalid. In particular, it should be noted that I will not be able to comment on the validity of the product claims.
11. My Opinion will therefore be restricted to an assessment of whether method claims 9 - 13 of the Patent are obvious over the teaching of D5 when considered in view of the CGK, as evidenced in D6. I will first consider the inventiveness of

independent claim 9. The inventiveness of dependent claims 10 to 13 will then be considered if necessary.

The Patent

12. The Patent is titled "Abrasive particles having a unique morphology". It was filed on 16 September 2009 and a European patent designating UK was granted on 15 July 2020. The Patent remains in force.
13. The Patent relates to a method for modifying the surfaces of diamond particles to provide a roughened surface that enhances their performance when used as abrasives, and to correspondingly modified diamond particles. The Patent describes how the modified diamond particles include significantly more spikes and pits than conventional monocrystalline diamond. The spikes act as cutting edges when the particles are used in free abrasive lapping applications within a liquid slurry or suspension. In a fixed bond system, the pits and spikes help to secure the particles within the bond system.
14. In an exemplary method of the Patent, diamond particles are coated with 10 to 60 weight percent nickel phosphorous coating. Diamond particles are initially subjected to a solution of colloidal palladium to render the surface of the particles autocatalytic for the electroless deposition of nickel, before being placed into the electroless deposition solution, which is maintained at a temperature of about 80°C. Following coating, the particles are placed into a furnace and are heated to a temperature of 650 °C to 1000°C in a hydrogen, vacuum or inert gas atmosphere for a period of between five minutes and five hours. The modified diamond particles are recovered by dissolving the coated diamond in common acids, which may include hydrochloric acid, hydrofluoric acid, nitric acid and certain combinations thereof. The mixture of acid and coated diamond particles is heated to between 100 and 120°C for a period from 6 to 8 hours. The solution is then cooled, the liberated diamond settles and the solution is decanted. The acid cleaning and heating steps are repeated until substantially all of the metal coating has been digested. Any converted graphite (carbon from diamond that has been converted to graphite during the reaction with nickel) is then removed from the diamond particles via any dissolution treatment method known in the art. The diamond particles are then washed, for example in water, and dried.
15. Figure 6A of the Patent is a two-dimensional illustration of a conventional monocrystalline diamond particle that has not been modified with a metal coating and figure 6B shows a two-dimensional illustration of the cutting points or teeth of a modified diamond particle. Figures 6A and 6B are reproduced below.



16. The Patent has thirteen claims, including independent claims 1 and 9, respectively directed to a product and to a method for making a product. As noted above, my Opinion will address the inventiveness of method claims 9 to 13.

17. Independent method claim 9 reads as follows:

A method for producing modified abrasive particles comprising the steps of:

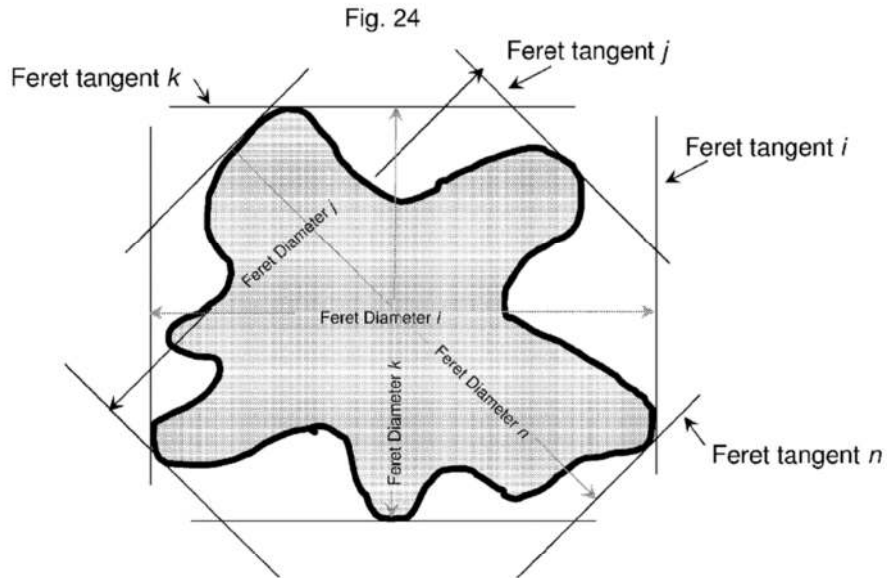
- i. providing a plurality of monocrystalline diamond particles;*
- ii. providing a reactive metal coating on said particles;*
- iii. heating said coated particles; and*
- iv. recovering modified abrasive particles;*

characterized by:

etching the diamond particles using the reactive metal coating configured to react with the diamond particles and convert the diamond to graphite; and
wherein the step of recovering the modified abrasive particles comprises removing the graphite from the diamond particles to provide the modified abrasive particles with pits and spikes;
wherein said modified abrasive particles comprising the pits and spikes provide the particles with an irregular surface having a surface roughness that is between 0.5 to 0.8;
wherein the term 'surface roughness' refers to the measurement of a two-dimensional image that quantifies the extent or degree of the pits and spikes of the particle's edges or boundaries as stated in the CLEMEX image analyzer, Clemex Vision User's Guide PE 3.5 ©2001 and wherein the surface roughness is determined by a ratio of the convex perimeter divided by the perimeter:

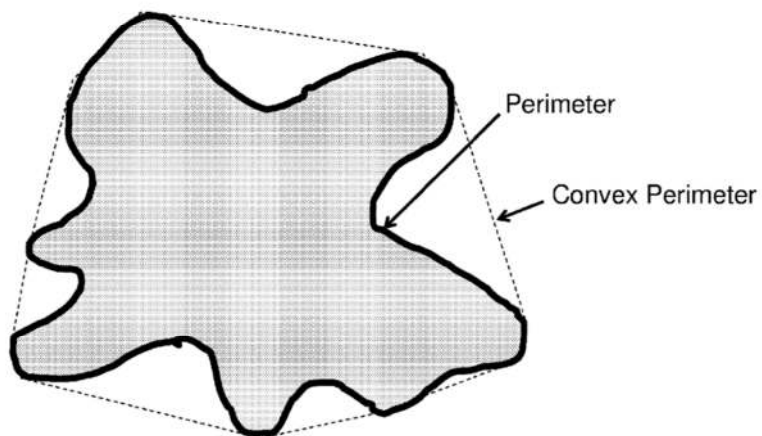
$$\text{Surface Roughness} = \frac{\text{Convex Perimeter}}{\text{Perimeter}}$$

18. The term "perimeter" is defined as the boundary of a closed plane figure or the sum of all borders of a two-dimensional image. The term "convex perimeter" is defined as a line joining Feret tangent points, where Feret is the distance between two parallel tangents touching the boundary on each side of a two-dimensional image or object. Figures 24 and 26, reproduced below, illustrate these definitions.



Feret diameter is defined as the distance between two parallel lines touching the boundary of a 2-dimensional image or particle profile.

Fig. 26



$$\text{Convex perimeter} = \sum \text{Ferets} (2 \tan) \times \left(\frac{\pi}{2(\text{number of ferets})} \right)$$

Claim Construction

19. Before considering inventive step, I need to construe the claims of the patent – that is to say, I must interpret them in the light of the description and drawings as instructed by Section 125(1):

125(1) For the purposes of this Act an invention for a patent for which an application has been made or for which a patent has been granted shall, unless the context otherwise requires, be taken to be that specified in a claim of the specification of the application or patent, as the case may be, as interpreted by the description and any drawings contained in that specification, and the extent of the protection conferred by a patent or application for a patent shall be determined accordingly.

20. In doing so I must interpret the claims in context through the eyes of the person skilled in the art. Ultimately the question is what the person skilled in the art would have understood the patentee to be using the language of the claims to mean. This approach has been confirmed in the recent decisions of the High Court in *Mylan v Yeda*¹ and the Court of Appeal in *Actavis v ICOS*².
21. Neither the Requester nor the Observer has put forward any argument concerning the construction of the claims. I also have no issue with the claims and consider them to be clear when read in light of the description and drawings. In my opinion the skilled person would have no issue with understanding the meaning of the claims.

Prior Art - D5

22. D5 is titled "Process for treating diamond grains" and was published before the priority date of the Patent. D5 discloses a process for roughening the surface of diamond grains to improve adhesion between the grains and a bonding material in which they are embedded when used in diamond tools, such as grinding wheels.
23. D5 teaches embedding or enclosing diamond grains in a metal powder and exposing the embedded grains to a stream of hydrogen or a hydrogen-containing gas at a temperature in the range 700°C to 900°C, whereby pores are etched in surface areas of contact of each grain with the metal particles. The resulting surface features are also described as being 'pits' and 'channels'. The diamond grains are subjected to cleaning with an acid to remove the metal powder from the roughened surface. The diamonds are then washed using pure water.

¹ *Generics UK Ltd (t/a Mylan) v Yeda Research and Development Co. Ltd & Anor* [2017] EWHC 2629 (Pat)

² *Actavis Group & Ors v ICOS Corp & Eli Lilly & Co.* [2017] EWCA Civ 1671

Common General Knowledge - D6

24. D6 concerns processes for electroless coating of abrasives, such as diamond and cubic boron nitride, with metals, such as nickel, for use in resin bonded abrasive tools. D6 teaches methods for roughening the surface of the metal coating to aid adhesion between the metal-coated abrasive particles and the resin in which they are embedded.
25. As noted by the Requester, D6 discloses a method in which the first two steps comprise contacting the non-catalytic material, i.e. the abrasive particles, with a catalytic material and then contacting the material with an aqueous solution containing coating metal ions and ions of a reducing agent capable of reducing the metal ions to the free metal. The Requester asserts that these first two steps (of a process comprising further steps aimed at roughening the surface of the coating) form part of the CGK.

Inventive Step – the Law

26. Section 1(1)(b) of the Act reads:

1(1) A patent may be granted only for an invention in respect of which the following conditions are satisfied, that is to say –
(a) the invention is new;
(b) it involves an inventive step;

27. The provisions in relation to inventive step are found in section 3 which states:

3. An invention shall be taken to involve an inventive step if it is not obvious to a person skilled in the art, having regard to any matter which forms part of the state of the art by virtue only of section 2(2) above (and disregarding section 2(3) above).

28. The Court of Appeal in *Windsurfing*³ formulated a four-step approach for assessing whether an invention is obvious to a person skilled in the art. This approach was restated and elaborated upon by the Court of Appeal in *Pozzoli*⁴. Here, Jacob LJ reformulated the *Windsurfing* approach as follows:

(1)(a) Identify the notional “person skilled in the art” ;
(1)(b) Identify the relevant common general knowledge of that person;
(2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;
(3) Identify what, if any, differences exist between the matter cited as forming part of the “state of the art” and the inventive concept of the claim or the claim as construed;
(4) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of

³ *Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd*, [1985] RPC 59

⁴ *Pozzoli SPA v BDMO SA* [2007] EWCA Civ 588

invention?

(1)(a) Person skilled in the art

29. The Requester considers the person skilled in the art to be "a designer of abrasive tools for industrial applications". The Observer, on the other hand, considers the relevant skilled person to be "a person with a background in material science and having experience of diamond and possibly other hard materials for use in industrial applications including those mentioned in paragraph [0044] of the patent". This paragraph mentions " applications including free abrasive applications, fixed abrasive applications, lapping, grinding, cutting, polishing, drilling, dicing, sintered abrasives or abrasive compacts, and wire for wire saws". As the Patent is concerned with modifying the surfaces of diamond particles for use in abrasive tools to provide a roughened surface, rather than the general design of abrasive tools *per se*, in my view, the skilled person is a chemist or materials scientist working in the field of abrasives.

(1)(b) Common general knowledge

30. The Requester defines the CGK as "including the behaviour of bonding materials utilized in diamond tools, for example, when using reactive bonding materials". They refer to the 'background of the invention section' of D5, in which a description of the use of reactive metallic bonding materials states that "the diamond surface is attacked to a greater or lesser degree, and a part of the diamond carbon is removed by the metal. The resulting roughness produced on the diamond surface can admittedly contribute to an improvement in the anchorage of the diamond grain in the bond". This seems to me to be rather specialised knowledge that I do not believe to be part of the CGK of the skilled person.

31. Whilst individual patent specifications and their contents do not normally form part of the relevant common general knowledge, I am in this instance prepared to accept that electroless or autocatalytic methods of preparing diamond grit as representatively disclosed in D6 are part of the CGK.

32. I consider that the CGK of the person skilled in the art would encompass general concepts and processes within the fields of chemistry and materials science and would also include a knowledge of abrasives, including hard particles such as diamond particles. As noted above, I also believe that their CGK would include methods for electroless coating of non-catalytic materials with metals.

(2) Identify the inventive concept of claim 9

33. The Requester considers that the inventive concept is "to roughen the surface of diamond particles to enhance their performance in industrial properties", noting that the pits and spikes provide this effect. The Observer states that "the inventive concept of the independent claims of the patent may be considered to lie in the surface topography of the monocrystalline diamond particles having pits and spikes with recited quantitative surface roughness".

34. I consider the inventive concept of claim 9 to be a method comprising coating a diamond particle with a reactive metal, heating the coated diamond particle to convert some of the diamond surface to graphite and removing the graphite from the diamond particle to form the modified abrasive particle having a significantly increased number of pits and spikes, as evidenced by the surface roughness value, which is defined as the convex perimeter divided by the perimeter, having a value of between 0.5 and 0.8.

(3) Identify what differences exist between D5 and the inventive concept of claim 9

35. The Requestor highlights the respective steps of embedding the monocrystalline diamond particles in nickel (in D5) and coating particles in nickel (in claim 9) as forming a difference. I am in agreement that these steps form a difference between the methods.

36. Both the Requester and the Observer point to the obtained surface roughness of 0.5 to 0.8 as forming the (or a part of) the difference between D5 and the inventive concept of claim 9. Again, I am in agreement with this assertion.

37. It is stated in D5 that, during heating, "pores are etched in surface areas of contact of each grain with the metal particles". The surfaces are also described as showing "numerous etching pits and channels". Claim 9 describes the modified particles as having "pits and spikes". It would seem therefore that different surface features are formed by the two methods.

38. It is explicitly stated in claim 9 that the reactive metal coating is "configured to react with the diamond particles and convert the diamond to graphite" and the recovery step comprises "removing the graphite from the diamond particles". I agree with the Observer that there is no explicit reference to graphite in the description of the method of D5. I do not agree with the statement in the observations in reply that the diamonds being "washed with pure water until their surfaces are free of meal and other possible residues" indicates that graphite has been formed as a by-product of the etching process.

39. As noted by the Requester, both methods use similar temperatures, atmospheres and treatment durations for the heating step. I also note that similar post-treatment particle recovery processes are employed in the two methods.

40. The Observer does not consider the diamond particles of D5 to be 'monocrystalline' diamond particles. I agree with the Requester's observations in reply that the references throughout D5 to 'diamond grains' and 'diamond crystals' amount to disclosure of monocrystalline diamond particles.

41. I therefore consider the differences between the two methods to be that claim 9 requires the deposition of a reactive metal coating on the monocrystalline diamond particles, wherein the reactive metal coating reacts with the diamond particles and converts diamond to graphite, while D5 teaches embedding monocrystalline diamond particles in a metal powder. There is no explicit reference in D5 to graphite and I do not believe it can be assumed that graphite is produced. The surface morphology produced by the two methods would also

seem to differ in that the particles produced by the method of D5 do not appear to comprise spikes. The two methods would each seem to result in a different surface roughness.

(4) Does this difference constitute a step which would have been obvious to the person skilled in the art or do they require any degree of invention?

42. The Requester states that "The person skilled in the art would readily understand from their common general knowledge that using reactive metal bonding coatings can be used to increase roughness of a diamond grit (from D5)". As noted above, I do not consider that the use of reactive metal bonding coatings to increase the surface roughness of diamond grit is CGK.
43. The Requester goes on to suggest that "the person skilled in the art could easily conceive substituting grits embedded in a reactive metal powder with grits coated in a reactive metal powder in the process of D5 and that it would be 'obvious to try it' with a reasonable expectation of success". They further state that "An example of a well-known electroless or autocatalytic method is even given in D6 for the person skilled in the art to follow".
44. I disagree with the Requester on this point. In my view, the electroless process provided in D6 does not coat the diamond particles with a reactive metal powder. During the coating process of D6, the particles are contacted with "an aqueous solution containing coating metal ions and ions of a reducing agent capable of reducing the metal ions to the free metal". I consider therefore that the diamond particles are not coated with a metal in a powdered form, nor are they coated with a metal alloy selected for its chemical reactivity with the diamond surface.
45. Furthermore, the CGK evidenced in D6 concerns electroless deposition processes that are generally used to coat particles with a metallic coating which is left in place during intended future uses of the particles. I do not believe that the skilled person would look to a such a method as being suitable for roughening the surface of diamond particles.
46. The Observer asserts in their comments "the importance of the finalising processing via a multistep extensive acid treatment to remove from the troughs of the pits and valleys both the reactive metal coating and then the graphite - both of which are bound strongly to the particles". It would seem that a straightforward replacement of the step of embedding diamond particles in a powder with a step of coating the particles would not be sufficient to produce the desired surface roughness. Changes to subsequent processing steps would also be required.
47. While it is my view that the CGK of the skilled person includes electroless deposition of metallic material onto the surface of diamond particles for bonding purposes, I do not believe that the skilled person would consider this CGK to be relevant to the method of D5, not least because the metallic material, for example nickel, is not being deposited for any reactive properties that it might possess if exposed to appropriate conditions, such as an elevated temperature. In my view, the skilled person would not be motivated to replace the step of embedding the diamond grains in a metal powder with the known electroless coating process to

deposit a metallic material. In my opinion, the skilled person would not, based on the teaching of D5 and CGK, have any expectation that a nickel coating deposited by a 'standard' electroless process, followed by the heat treatment process disclosed in D5, would generate the required surface roughness features on the diamond particles.

48. It is therefore my opinion that independent claim 9 is not obvious in light of D5 and the CGK of the skilled person, as evidenced in D6.

Dependent claims

49. I have found independent claim 9 inventive and so, by view of their dependency, claims 10 - 13 are also inventive.

Opinion

50. I consider that the invention of claims 9 - 13 is inventive over D5 and the CGK of the skilled person.

Karen Payne
Examiner

NOTE

This opinion is not based on the outcome of fully litigated proceedings. Rather, it is based on whatever material the persons requesting the opinion and filing observations have chosen to put before the Office.