

providing a solid base followed by a 'porous (lattice) structure' formed integrally with the base by additive layer manufacturing (ALM). Onto this the ceramic layer is heat sprayed. The intention is that the porous (lattice) structure is able to provide better bonding to the ceramic layer.

- 5 This structure can be better understood with reference to Figures 1 & 2, reproduced below. These show the physical structure of the embodiment of the invention:

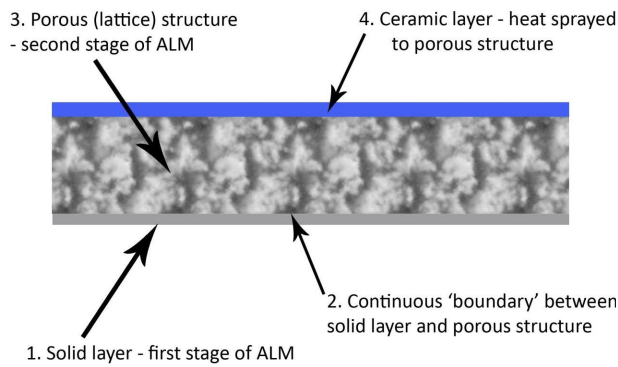


Figure 1

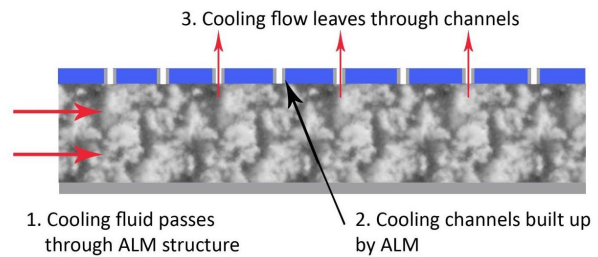


Figure 2

- 6 The claims currently on file are those submitted on 24 October 2022. There is one independent claim, claim 1, and three dependent claims, which are all directed to sandwich panels as follows:

Claim 1

*A sandwich panel consisting of a layer of solid material followed directly by a controlled lattice structure, said continuous solid layer and lattice structure having been formed using additive layer manufacturing (ALM), and coated with a ceramic material to complete the sandwich panel which when subjected to heat the **lattice strands** which form the interface with the ceramic layer are able to deflect thus reducing the interface stresses and maintaining a good bond.*

Claim 2

*A sandwich panel as in the preceding claims in which fluid can flow **between** the lattice structures and also through them.*

Claim 3

A sandwich panel as in claim 2 in which the cooling flow channels have capped off ends on the open side of the panel such that they would not be filled during the coating process and can then be uncovered by grinding off the capped ends.

Claim 4

A sandwich panel as described in any of the previous claims in which the coating layer is bonded to the porous or lattice structure by means of an additive layer manufacturing technique.

(Emphasis added to highlight possible added matter)

The Issues

- 7 There are several issues that require my attention:
- a. Do claims 1 & 2 as amended include added matter?
 - b. Is there an enabling disclosure in the application, making it sufficient?
 - c. Whether the claims contain non-allowable product-by-process features?
 - d. Is the application novel and inventive over the cited prior art?
 - e. Given that it is more than 2 months since the compliance period elapsed do/can I allow it to be sufficiently extended?

The Law

- 8 Section 1(1) of the Act sets out what is required of a patentable invention

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;

...

and references in this Act to a patentable invention shall be construed accordingly.

- 9 Section 2 of the Act sets out what 'new' means as follows:

2.-(1) An invention shall be taken to be new if it does not form part of the state of the art.

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

(3) The state of the art in the case of an invention to which an application for a patent or a patent relates shall be taken also to comprise matter contained in an application for another patent which was published on or after the priority date of that invention, if the following conditions are satisfied, that is to say –

(a) that matter was contained in the application for that other patent both as filed and as published; and

(b) the priority date of that matter is earlier than that of the invention.

10 Section 3 of the Act 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).

11 Section 14(3) of the Act sets out the requirements of the patent in order for it to be granted:

14.-(3) The specification of an application shall disclose 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.

12 Finally, Section 76(2) of the Act discusses ‘added matter’ as follows:

(2) No amendment of an application for a patent shall be allowed under section 15A(6), 18(3) or 19(1) if it results in the application disclosing matter extending beyond that disclosed in the application as filed.

Added Matter

13 As is often the case when there are multiple issues to be heard it is best to deal with the issue of added matter first to ensure that any analysis of the claims for further substantive issues can be based on allowable claims.

14 The alleged added matter in claim 1 is the use of the term ‘*lattice strands*’. In their report, the Examiner has highlighted that the only disclosure of strands in the application as filed is for ‘ALM strands’ in the final paragraph of page 1. The Examiner felt that there was insufficient disclosure in the application for a skilled reader to get from ‘ALM strands’ to ‘lattice strands’ implicitly.

15 Following *Flexible Direction Indicators Ltd’s Application*¹) they correctly argued that it isn’t enough for it to be an obvious step to get from one disclosure to the other. The proper test is set out in *Bonzel*² where Aldous J described the task as

¹ *Flexible Direction Indicators Ltd’s Application* [1994] RPC 207

² *Bonzel and Schneider (Europe) AG v Intervention Ltd* [1991] RPC 553

(1) to ascertain through the eyes of the skilled addressee what is disclosed, both explicitly and implicitly in the application;

(2) to do the same in respect of the patent as granted;

(3) to compare the two disclosures and decide whether any subject matter relevant to the invention has been added whether by deletion or addition. The comparison is strict in the sense that subject matter will be added unless such matter is clearly and unambiguously disclosed in the application either explicitly or implicitly.

- 16 Reading the description, it appears to me that prior to the last three paragraphs of page 1, most of the discussion revolves around prior art arrangements where porous substrates are made of metal foams. I believe that the final three paragraphs of page 1 are key, so I will discuss these now and add my own emphasis where relevant. The first paragraph of the last three on page 1, refers to having the ability to design and tailor the structure of the **porous (or lattice) structure** and it may be 'beneficial' to have the **lattice design** varying throughout the structure. The second goes on to state how **ALM** allows the backing part and the **porous section** to be formed continuously, increasing the strength of that boundary. The third then states that the **ALM strands** which form the interface with the ceramic can deflect into the voids within the **ALM structure**.
- 17 I believe it is clear that the terms "porous" and "lattice" are considered synonymous and interchangeable when discussing the embodiment, so 'the porous section' can also be read as 'the lattice section'. When discussing 'ALM strands', it is explicit that such strands are formed in the portion of the substrate immediately adjacent the ceramic layer and that this portion of the base substrate is in the porous/lattice portion. As such, the skilled person would appreciate that the ALM strands are strands of the lattice – there is simply nothing else they could be.
- 18 Turning now to claim 1 as amended, this now refers to "**lattice** strands which form the interface with the ceramic layer" and "are able to deflect". Since the skilled person knows from the description that the lattice is formed by ALM they will appreciate that this term can only refer to the "ALM strands" discussed in the description as performing exactly that function. From this, I do not think that it is merely obvious that the ALM strands could be lattice strands, but rather that it is **implicit** that "ALM strands" and "lattice strands" are interchangeable terms for the same thing. As such the skilled person learns nothing new (other than an alternative name) and I conclude that there is no added matter in claim 1.
- 19 The alleged added matter in claim 2 revolves around whether the coolant flows '**between**' the lattice structures as well as 'through' them. I will not dwell on this long. The Examiner has argued that this implies that there are multiple lattice structures which constitutes added matter. I do not believe this to be the case, there is clearly only a single lattice disclosed, it is just that its structure may comprise many interconnected 'portions' between which the coolant can flow. That is the only

construction supported by the description as filed, so it is the one I will use. With such a construction there is no added matter in claim 2.

Lack of Enabling Disclosure

- 20 The issue here that the Examiner has pointed out is that the application lacks detail regarding exactly what the lattice portion is made of, how it allows formation of the ceramic layer and how it deflects in response to thermal expansion. I am somewhat sympathetic to this position as the application is very sparse with regards to detail, however, a lack of detail alone is not grounds for objecting to lack of enabling disclosure if the gaps in detail can be filled by a skilled reader's common general knowledge and/or routine trials.
- 21 The first part of the Examiner's objection revolves around the use of 'lattice strand' and 'ALM strand'. As I have already discussed this above, the lattice/ALM strand is simply a strand in the ALM lattice. What does this mean in practice? What form is the porous section if it can be described as an ALM constructed lattice that has strands and allows fluid flow through it? When considering the meaning of lattice in the field of science and engineering, two main structures with 'strands' come to mind: a macroscale lattice structure, like a metal girder bridge or a pylon; or a microscopic crystal lattice structure. Both have common features, namely linkages/strands which extend between nodes joining multiple strands and gaps between the strands. In both cases, one key feature of the structure is that it allows flexing ('deflection') in the strands in response to external stress. Another is that such lattices are 'open' allowing fluid to flow through them. Since both these features are required by the invention, I believe that this kind of structure would be what a skilled reader would understand the application to be referring to. While other lattice structures, such as honeycombs, are known, these structures do not have any feature that might be described as flexible strands and they are not 'open' to allow the required fluid flow.
- 22 The second part of the Examiner's objection relates to the material of the lattice. Again, they are correct in that it isn't explicit what the material is made of, although it can be easily inferred. As the Examiner points out, it is possible to perform ALM with metallic materials, the material must also be strong, flexible and given the use in propulsion, light weight. This restricts the required materials immensely and I believe that the skilled person could determine suitable options without need for more than routine trials.
- 23 The third issue raised is the interface between the lattice and the ceramic layer. The application teaches that the ceramic layer is either heat sprayed onto the lattice or also deposited by ALM, the latter requires no explanation. Heat spraying does require some consideration, assuming the lattice has to be light weight, and also considered 'porous' the assumption must be that the size of the lattice is quite small. In this case, then when heat spraying, the ceramic particles will collect on upper portions of the lattice but if the size is small enough, then ceramic will collect more near the surface and, over time, become thick enough to stop particles reaching the lattice below. At this point, the ceramic will have formed a layer which is bonded to the top layers of the lattice, these points in the lattice would remain static with

relation to the ceramic, however, the strands which contact those parts of the lattice would be free to deflect in response to thermal expansion, as described.

- 24 While I am far from the skilled person, I concluded all of the above with only a little thought after reading the application. If I can do this, then I am confident that the skilled person could take the disclosure and make the claimed sandwich panel. They might have to consult with people who know how to perform ALM and how to heat spray ceramics, and perform a few routine trials with different lattice structures but I believe they could do so without needing any further invention. In short, I conclude that there is an enabling disclosure in the application, when considering the skilled reader's common general knowledge.

Product-by-process

- 25 I will not discuss this in any great detail. The skilled person would appreciate that constructing a panel using ALM conveys certain features which are inherent in the process, i.e. precise control over the lattice's structure, and the solid layer and the lattice being integrally formed and thus enjoying a stronger interface than, e.g., welding. Further these benefits are not incidental to the panel of the invention – they are a central part of the invention. It is the use of ALM to create a certain type of panel that the applicant is looking to protect.
- 26 Thus, for this application, I conclude that the use of 'product by process' claims is allowable. The restriction to ALM is a key part of the invention and would not cause a skilled reader to doubt the scope of the claims.

Novelty and Inventive Step

- 27 The examiner has cited three documents on which their novelty and inventive step objections are based. These are:
- D1: US2012196147 A1 20120802 [] (RABIEI AFSANEH);
- D2: DE102012016309 A1 20140220 [] (FRAUNHOFER GES FORSCHUNG)
- D3: US2011262695 A1 20111027 [] (LEE CHING-PANG et al)
- 28 Again, I will not dwell on this issue in any great detail. The Examiner makes objections using this prior art but with a construction of the claims which is directed by the objections I have discussed, and dismissed, above.
- 29 However, I will briefly comment on the prior art, with the construction that 'lattice strand' is equivalent to 'ALM strand' and the lattice layer must have the type of structure I have discussed above.
- 30 The citation D1 discloses a 'lattice' made from hollow metallic spheres with the interstitial spaces between the spheres being filled by another metal. There is also the disclosure of an embodiment with a ceramic layer in addition to this lattice.

However, the lattice disclosed in this document could not have strands, as I have construed the term above, which could deflect as required and so this document does not anticipate the current invention. Neither does it comprise a solid layer and lattice structure formed by ALM. The differences between document D1 and the current invention are large enough that I cannot consider the latter an obvious variation from the former.

- 31 Citation D2 discloses a panel with a solid surface and an adjacent lattice section. Either or both sections may be ceramic and are formed using ALM. The lattice structure disclosed here though is a honeycomb structure with its hexagonal spaces running perpendicular to the solid surface. Again, this lattice could not have strands which could deflect as required by the claims and so it is my view that this document also does not anticipate the current invention. Neither does it render it obvious – there is no simple way to modify the lattice of D2 to generate the required features of the current claims nor any reason to attempt to do so.
- 32 Citation D3 discloses a structure in figure 5 which appears akin to my understanding of the present invention. The Examiner points out that it does not disclose additive manufacturing, however there is discussion of direct metal laser sintering, which is an additive manufacture process. Claim 9 of this document effectively defines the lattice structure shown in figure 5 provided between two walls. I have considered the disclosure of this application and it describes the lattice structure as providing strength and even cooling, however it does not describe the lattice as being flexible. Further, there is no discussion of the lattice being bonded to a separate ceramic layer, only that the lattice and two walls being formed of the same material. If it is taken that the whole device is formed of ceramic, then there would not be the necessary flexibility in the lattice. Therefore, I believe it would require an inventive step or hindsight for a skilled person to get to the claimed invention from document D3. As such, I believe that the current invention is novel and inventive over this citation too.

Other issues

- 33 I find that the application does not contain added matter, nor is it insufficient. Having read the cited prior art, I also find that the claimed invention is both novel and inventive in light of those documents. I thus conclude that the application was in order when the compliance date expired on 24th October 2022. On this basis I should remit the application back to the examiner for grant.
- 34 However, I note that in their pre-hearing letter of 30th November 2022, while the Examiner stated that the search on the application was complete, this was based on their understanding of the construction and scope of the claims which they considered unclear. They therefore retained the option for further searching. Thus, I could remit the application back to the examiner for a further search. The problem here though is that the compliance period expired more than two months ago.
- 35 On this point I note that while the examiner informed the applicant of the compliance period they did not explicitly warn them that it would need extension despite doing so in a letter issued after it had expired. As an unrepresented applicant they obviously

were unaware of the need for extension and may reasonably have assumed that they should wait patiently for my decision to issue before acting further. I am also aware that had I issued this decision in the fortnight immediately after the pre-hearing report was issued the applicant would have been able to apply for a retrospective extension.

- 36 Given the above facts I conclude that the expiry of the compliance period is at least partially the fault of the Office. As such, under rule 107, I am empowered to take what measures I deem reasonable to correct this oversight. I therefore hereby extend the compliance period to two months after the issue of this decision.

Conclusion

- 37 I have found that, based on the citations on file, the application is in order. I remit the application back to the Examiner to decide whether or not further searching is required. If not, I direct that the application should be granted.
- 38 I have also extended the compliance period to two months after the issue of this decision.

Dr Stephen Brown

Deputy Director, acting for the Comptroller