PowdermatriX

SPARK CASE STUDY

CURVES IN ALL THE RIGHT PLACES

What's the story?
Applied Functional Materials Ltd (AFM Ltd), a spin-out company from the University of Birmingham, is one of the world's leading manufacturers of complex shaped ceramic devices.

One such device is known as a piezo-composite. Widely used in ultrasonic applications such as SONAR, non-destructive testing and biomedical imaging, piezo-composites are comprised of ceramic piezoelectric pillars (usually a lead zirconate titanate (PZT) material in an epoxy matrix).

Piezo-composites have been proven to perform better, i.e. have a higher output and better acoustic matching to the surrounding medium, than just using a sintered ceramic block. However, the manufacturing process, which involves mechanically cutting a sintered ceramic block to create a pillar array, is currently slow, wasteful of material and limited to simple pillar shapes and planar composites.

AFM believed that a more efficient manufacturing process could be used to create curved piezo-composites and was awarded SPARK award funding to test its theory.

What went on?
Researchers at the University of Birmingham, the solution provider for this particular SPARK award, selected waxes that would make suitable mould materials, i.e. would be suitable for casting, machining and could be removed easily once the ceramic had dried.

Initial moulds were cast around metal pillars of approximately the right dimensions, which were then filled with compatible ceramic slurries. Using standard alumina powders at this initial test stage, prototype curved pillar structures were successfully created.

In order to produce useable piezo-composites, a slurry with higher ceramic content was required, along with tighter pillar dimensions. To achieve this, a new machined cast wax mould was created.

What happened?
Inspection of the final sintered structure produced did reveal some fine defects, the origin of which is now the subject of further investigation by AFM.

However these initial feasibility tests made possible by SPARK Award funding have shown that manufacture of curved piezo composites is possible and, once the initial processing issues have been resolved, could result in a commercial deal for AFM worth approximately £200k.

As well as this, the SPARK Award study has also led to the development of a new moulding technique that has great potential for a number of application areas.

The benefits of this project also extended to personnel involved as the masters student that carried out the work is keen to continue the research, possibly studying for a PhD via the CASE Award scheme.

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