Case Study: Using ceramics for greener space technology

Morgan Advanced Materials

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The challenge

Researchers at the Space Plasma, Power and Propulsion laboratory at the Australian National University (ANU) needed just the right material from which to make a custom-made plasma cavity for their unique Helicon Double Layer Thruster (HDLT), a new gas plasma space engine being developed for use on satellites. The technology is becoming more and more popular, because it uses greener, less toxic propellants.

ANU was conducting research and development on the plasma technology in cooperation with a number of industrial partners. ANU researchers knew they needed ceramic for the plasma cavity, which has to withstand the heat that creates the plasma. Metal would not be suitable since heat from the radio frequency must be able to pass through into the plasma; with metal, the heat would just have been reflected. After having trouble sourcing suitable solution from Australian manufacturers, ANU connected with Morgan

How Morgan worked with ANU to develop a solution

Morgan suggested to ANU researchers that its AL300 Alumina might be an excellent match for the cavity, which is about the size of grapefruit. The 97.6 percent pure alumina enables components and brazed assemblies to be machined to exact tolerances and finished to ensure consistently high performance.

The material has been used for decades in high-voltage and RF applications, and is known for its excellent electrical properties. It had already been successfully used to manufacture components generating plasma and in high voltage insulation scanning electron microscopes.

Morgan experts reviewed ANU's drawings, providing feedback on how to make the geometry robust. They also offered a tolerance review to help achieve the most affordable part. Morgan then developed an in-house process to make the parts out of the AL300 Alumina. The parts have a thin wall and a long aspect ratio and special care was taken to fire to size. Once fired, Morgan only had to grind in one dimension.

Electric propulsion satellites are part of new and greener space technology.

The success removed a significant problem ANU researchers had been worried about from the project's outset.

The result.

Using its custom in-house process, Morgan achieved first pass success on the ceramic cavity part, which ANU had designed so that it could be simply and easily attached to the chassis for all the tests. Morgan then provided five of the finished prototypes within an extremely short lead time, so the parts could be used for space qualification and prototype development.

The ANU researchers have been extremely pleased with the result, finding the ceramic cavities supplied by Morgan Advanced Materials to be extremely sturdy, well within the tolerances they required. They called the material easily the best they had tested for the cavity.

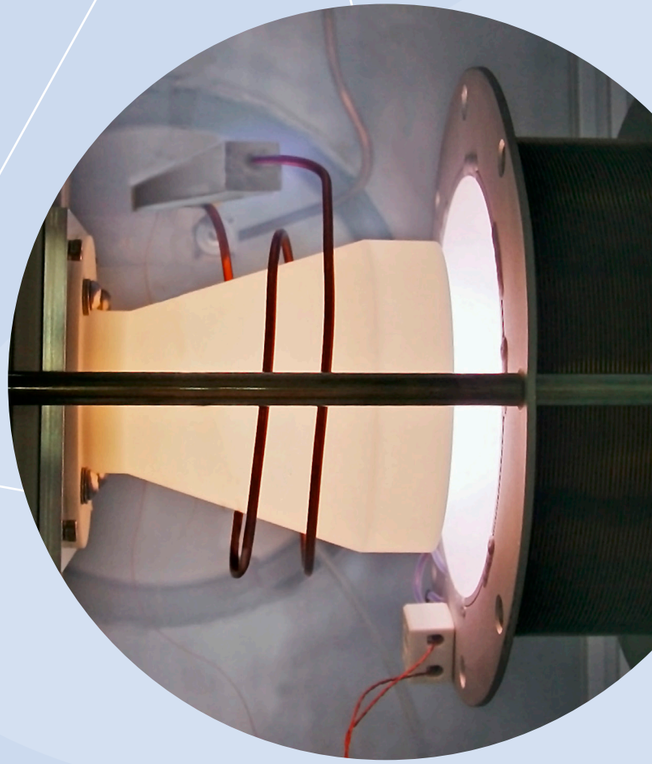
The success removed a significant problem from the project – one ANU researchers had been worried about at the project's outset.

This exciting R&D prototype is the first of many iterations that are likely to take place as the technology goes through a rigorous design and development process before being commercialised.

The entire unit had a much lower centre of gravity, making steering easier and optimising speed of travel.

"THE MATERIAL TURNED OUT TO BE THE BEST WE'VE EVER TESTED"

Australian National University



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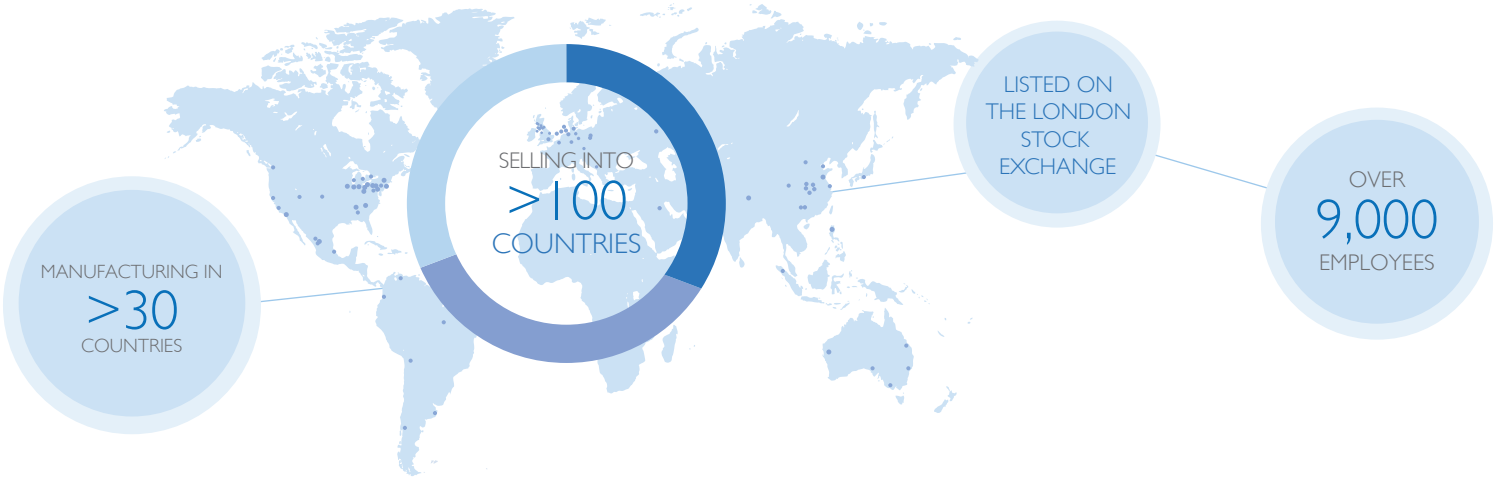
ABOUT MORGAN ADVANCED MATERIALS



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We focus our resources on the delivery of products that help our customers to solve technically challenging Problems, enabling them to address global trends such as energy demand, advances in healthcare and environmental sustainability.

What differentiates us?

- Advanced material science and processing capabilities
- Extensive applications engineering experience
- A strong history of innovation and reinvention
- Consistent and reliable performance
- A truly global footprint
- We find and invest in the best people

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