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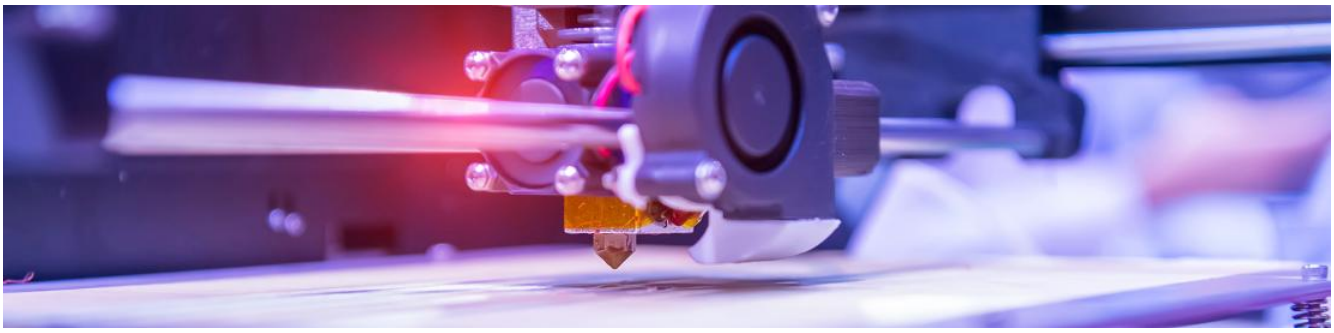

Advanced manufacturing revs up in Europe with 3D printing

3D printing is set to revolutionise European manufacturing, producing complex, multilayered components for everything from toys and cars to wind turbines and satellites.

10 September 2024 - By ANTHONY KING

If 3D printing makes good on its promise, it will fundamentally change the way things are manufactured. And it could also become everyone's best friend. Just imagine if for any broken part in your household, you could simply make a new one with your home printer.

Thanks to advances made by an EU-funded research team, it is now possible to print advanced parts for motorbikes, cars, aircraft and even satellites using different materials and shapes while producing much less waste. It is even possible to embed electrical conductors or optical fibres that can act as sensors.

Multilayered manufacturing

This is because 3D printing can allow parts to be created layer by layer, making it easier to seamlessly combine, for example, metals, plastics, ceramics and even fibreoptics together, in one part, in a single process. This enables companies to make smarter parts using exactly the amount of material needed, thus reducing waste to a minimum.

Rudolf Gradinger, a research engineer at the Austrian Institute of Technology, is one of the researchers helping to drive these developments forward. He headed up a three-year multi-country research initiative called MULTI-FUN that received funding from the EU to push the boundaries of 3D multi-material manufacturing.

The MULTI-FUN team, which worked together over three and a half years until December 2023, included researchers and industrial partners from across Europe (Austria, Belgium, Germany, Poland, Portugal, Spain, Switzerland, UK). Their focus was on developing innovative advanced materials ready for market. The participation of nine SMEs played a key role in helping to accelerate market uptake.

Gradinger highlights the example of an airplane part containing optical fibres. The researchers built up the part layer by layer using aluminium and embedding optical fibres. This gave it “impossible superpowers”.

‘The nerves in your arm mean you can sense when your arm gets twisted,’ said Gradinger. ‘These optical fibres are like nerves and can sense when a part bends too much or becomes damaged.’

Improved functionality was also the aim of Richard Kordass, a design engineer at German automotive company EDAG, one of the partners in the research team. They developed motorbike handlebars printed with copper wiring and ceramic insulation built in.

‘The only way that is possible is by additive manufacturing,’ stressed Kordass.

So much progress has been made that Rita Gomes Bola from the European Welding Federation in Belgium, who also worked on MULTI-FUN, believes that the latest advances have fundamentally changed how design engineers work.

‘We can now rethink how parts are designed in ways that manufacturers never even dreamt of,’ she said.

Aiming for the moon

The possibilities of 3D printing extend to the creation of high-performance parts for the space industry. The researchers created a special casing for a motor used on space satellites. Its steel body incorporated copper highways for significant improvement of heat management of electric drives.

‘We doubled the heat transfer rate so the electric motor can now operate faster and not get so heated,’ said Gradinger, explaining that temperature is part of what causes metal parts to fatigue.

Damaged parts can stop working or need repair, which is practically not feasible when a satellite is orbiting the Earth. This makes the space industry a prime candidate to benefit from 3D printing advances.

The EU currently accounts for 22% of the world’s manufacturing output, delivering a trade surplus in manufactured goods of €421 billion each year. This is why the EU is investing in research to further strengthen this sector.

Additive manufacturing is seen as central to the EU’s manufacturing future and is supported through various initiatives, including the Made in Europe and Factories of the Future partnerships with industry. The aim is to boost the industrial competitiveness of European companies in areas such as aerospace, automotive production and healthcare.

When 3D printing was first introduced in manufacturing, it was mostly used to create prototypes. Now, however, it has evolved to become a key part of the manufacturing process, making it faster and more efficient.

‘We’ve moved from rapid prototyping to rapid manufacture,’ said Kordass.

3D printed parts are already being used in the aerospace and automotive industry where they help to reduce fuel consumption. Siemens in Germany already 3D prints gas turbine blades, while Airbus uses printed parts in commercial aircraft to save on weight and fuel.

Spreading the word

Although additive manufacturing is rapidly becoming a part of modern industrial production, it is not equally advanced across all of Europe. Professor Liviu Marsavina, vice rector for research at the Politehnica University Timisoara in Romania, is part of a team of European researchers who have been working hard to spread 3D printing knowhow more widely across the EU.

Marsavina, a professor in strength of materials and fracture mechanics, coordinated an EU-funded initiative called SIRAMM that ran from 2019 to 2023.

It connected researchers in Romania, with researchers from the Institute of Physics of Materials at the Czech Academy of Sciences (IPM) in Brno, Czechia, the University of Belgrade in Serbia, the Norwegian University of Science and Technology and the University of Parma in Italy. Its goal was to create a hub of excellence in additive manufacturing in Eastern Europe.

Academic exchanges helped to create a network that has lasted beyond the end of the project itself.

‘We now have a network in which we know where we can solve different types of problems,’ said Marsavina. Meanwhile, companies in Romania, Serbia and Czechia are also more aware of additive manufacturing experts and equipment on their doorstep.

For Marsavina, the rapid advance in 3D printing potentially raises new issues relating to safety and security.

‘People are moving towards using 3D printing to build not only small parts, but also larger structures with more complex shapes. There is a need to know more about the properties and reliability of these new structures,’ he said.

The research team worked on addressing these issues through real-world research, in collaboration with their academic partners and industry representatives interested in 3D printing.

The technology, Marsavina predicts, will spread to many other industries and even to households.

‘We could one day have a 3D printer in our homes so that broken parts could be replaced by just printing them yourself.’

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