LPW Technology Ltd

Leader in 3D metal powder development and supply

Key facts/data:
LPW Technology Ltd

Technology: Metal Additive Manufacturing

Established: 2007

Type: Start up

Location: Runcorn, nr Liverpool

Employees: 70

Founder & CEO: Dr Phil Carroll

Before founding LPW, Phil Carroll worked at the consultancy, TWI Ltd, where he developed several Laser Metal Deposition repairs for Rolls-Royce Trent engines which have since entered production. Here he gained 11 years' experience in Additive Manufacturing. His PhD in Advanced Metallurgy was earned at Sheffield University.

LPW's goal is to offer the best metal powders for Additive Manufacturing adding quality, testing and traceability throughout the AM process.

Dr Phil Carroll, CEO & Founder

LPW Technology Ltd

Leader in 3D metal powder development and supply

Follow your passion

The Founder of LPW Technology, Dr Phil Carroll, established his reputation as a leading expert in metal Additive Manufacturing (AM) - also known as 3D metal printing - at the internationally renowned metals and welding consultancy, TWI.

He left TWI in 2006 with a plan to spend more time working from home; in reality, he was soon travelling even more, especially overseas. To reconcile his passion for the metal 3D printing industry with time to spend with his family the solution he decided was to pursue his dream of establishing a world-class metal Additive Manufacturing business, and so in 2007 he founded LPW Technology Ltd.

Starting the challenge

Having spent many years assisting companies in the new area of 3D metal printing, Carroll had become an authority on the idiosyncrasies of the metal powders that the AM process involves. As a result it was clear to him there was an education exercise required to support customers to understand the intricacies of powder manufacture and variability. A common misunderstanding, for example he explains, is the assumption that metal powders will behave predictably, like a normal metal material. In reality, the same metal powder will not behave the same across all AM machines, so that different powder properties of sizing, flow, morphology will be required for optimum results from each machine.

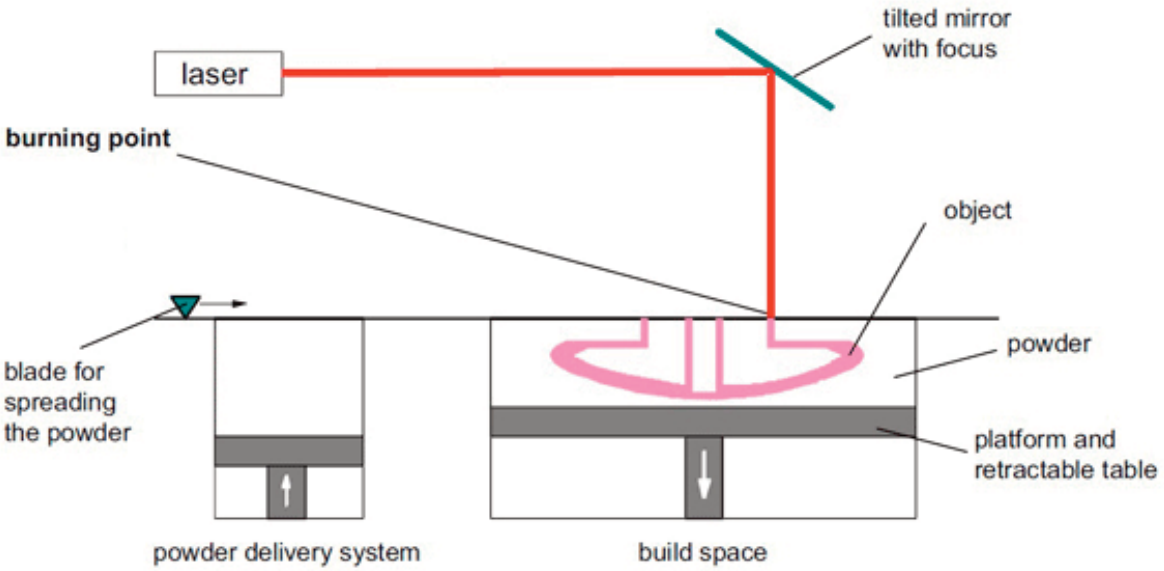
LPW Technology Ltd

Leader in 3D metal powder development and supply

How the AM Process works

Almost every AM system uses a powder deposition method consisting of a coating mechanism to deliver and spread a powder layer onto a substrate plate. Once the powder layer is distributed it is selectively melted using an energy beam applied to the powder bed; this energy source is normally a high-powered laser. The melting process is repeated layer by layer until the last layer is melted and the parts are fused and complete.

Selective Laser Melting

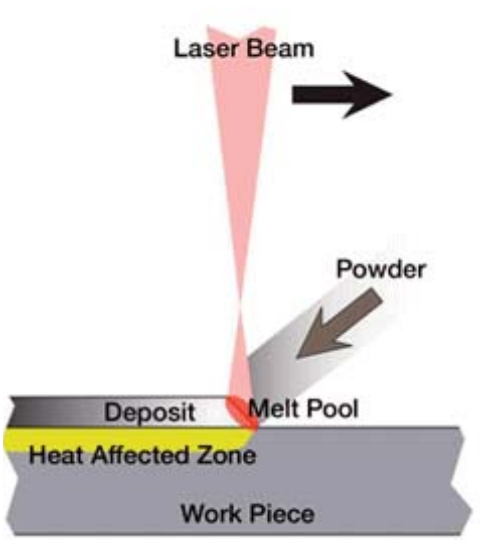


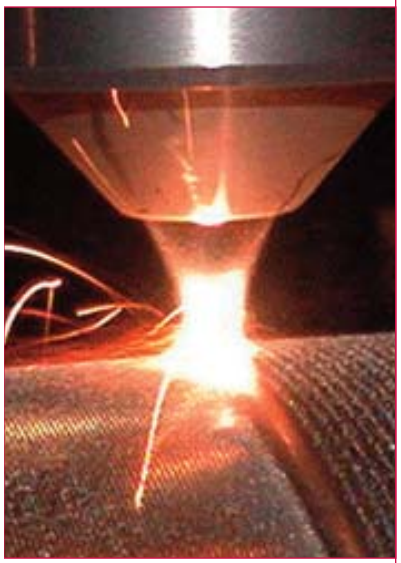
Schematic diagram of the Selective Laser Melting (SLM) powder-bed process (Source VDI 3404)

Laser Cladding system

An alternative powder-fed system is Laser Cladding where the powder flows through a nozzle being melted from a beam on the surface of the treated part.

In each case the powder material that is not used to manufacture a part is removed from the build and either collected for reuse or the excess powder disposed of.





Schematic of the laser cladding process (Courtesy Sulzer Ltd)
and the laser cladding process in action

LPW Technology Ltd

Leader in 3D metal powder development and supply

Reproducible behaviour

Generating a component by metal Additive Manufacturing (AM), relies on building the final design through a series of many thousands of layers. To achieve good flow and high packing density AM metal powders should be spherical with minimal satellites. Whilst different metal powders can be selected depending on the required performance of the final part, reproducible behaviour of the powder throughout the process is key to successful builds.

Intelligence bridge

Understanding that the quality, consistency and correct specification of the metal powder is key to a successful 3D build, LPW applies its expertise to identify the correct metal powder to use for a particular application and specific AM machine. This allows LPW to serve as a bridge between the raw metal powder supplier and the final user, whereby it adds value to the process as opposed to serving as a service bureau for powder mills, says Carroll.

Added insight

With its industry experience and knowledge LPW is also able to provide both powder testing services on customers' materials, and component testing, as part of a component validation, or as a root cause analysis in the case of a failed build. LPW can also offer detailed advice on specific applications and engage in joint R&D projects.

Plasma Spheroidisation

In early 2016 LPW acquired a 'Plasma Spheroidiser' from a US company so that it could experiment with the production of increasingly spherical particles with reduced oxygen content. The spheroidiser uses a high-energy plasma to transform agglomerated powders that have been produced by spray-drying or sintering techniques, or angular powders produced by conventional crushing methods. LPW's plasma spheroidisation process improves the morphology, flow and packing properties of low sphericity, irregular, angular, metal powders produced by methods such as water atomisation, chemical and mechanical routes and standard gas-atomised methods.

Carroll says of their investment in the Spheroidiser, "I'm not inventing processes, we are adapting existing ideas and processes and developing and applying them to research materials suited to critical applications".

Benefits of spheroidisation

The Plasma Spheroidiser achieves a much more spherical powder with improved flowability and packing density, making it especially suited to AM machines where finer powder is required. In addition, levels of powder surface contamination, compared to conventional gas-atomised powders, are reduced which has the potential to enhance mechanical properties in the finished AM component.

Caroll says that LPW's aim in creating small volumes of spheroidised powder is not to compete with existing metal powder suppliers but to "plug a gap" in the market which bulk powder suppliers are not filling, and to understand and develop materials with enhanced properties for reliable additive manufacturing.

LPW Technology Ltd

Leader in 3D metal powder development and supply

Garbage In, Garbage Out

The other key observation from Carroll's time at TWI is that metal powder, which is not used in making a component, can be recycled to use again, but the problem soon encountered is: "Garbage In, Garbage Out". This is because the powder that begins the AM process changes during the melt process; for example: it oxidises easily in the presence of heat from the laser; it can pick up moisture during storage; operators can make mistakes - all potentially leading to a significant change in the properties of the powder subsequently entering the build process. While this may be acceptable making a simple prototype, says Carroll, it is not acceptable when making a vital component for a critical application such as aerospace.

PowderLife

Assurance that the powder is right for the job provides another opportunity for LPW to add value. "Don't waste money and take the risk assuming the powder is good, know the powder is good", says Carroll. LPW's suite of products and services can track, control and measure the powder from initial supply through process steps to re-use. They call the process, 'PowderLife'. The received powder is analysed, then may be blended in multiple batches and re-sized; it can also be post-processed using the Plasma Spheroidisation. Aside from ensuring quality of the powder, it allows the powder to be used multiple times, which for high volume powder users can generate considerable cost savings.

Global sales

LPW has found a significant niche in the global AM market. Sales break down broadly 40% to Europe, 30% to North America, 20% to UK and 10% to Rest of the World (mainly China and Japan). Its customers are typically university laboratories, 3D metal print bureaux, AM machine suppliers, and direct end users in the aerospace, automotive, medical, defence and energy sectors. Expansion has been quick - LPW opened its first overseas sales office in the USA in May 2014, followed by Germany at the end of 2015, and then Italy in June 2016.

Capacity expansion

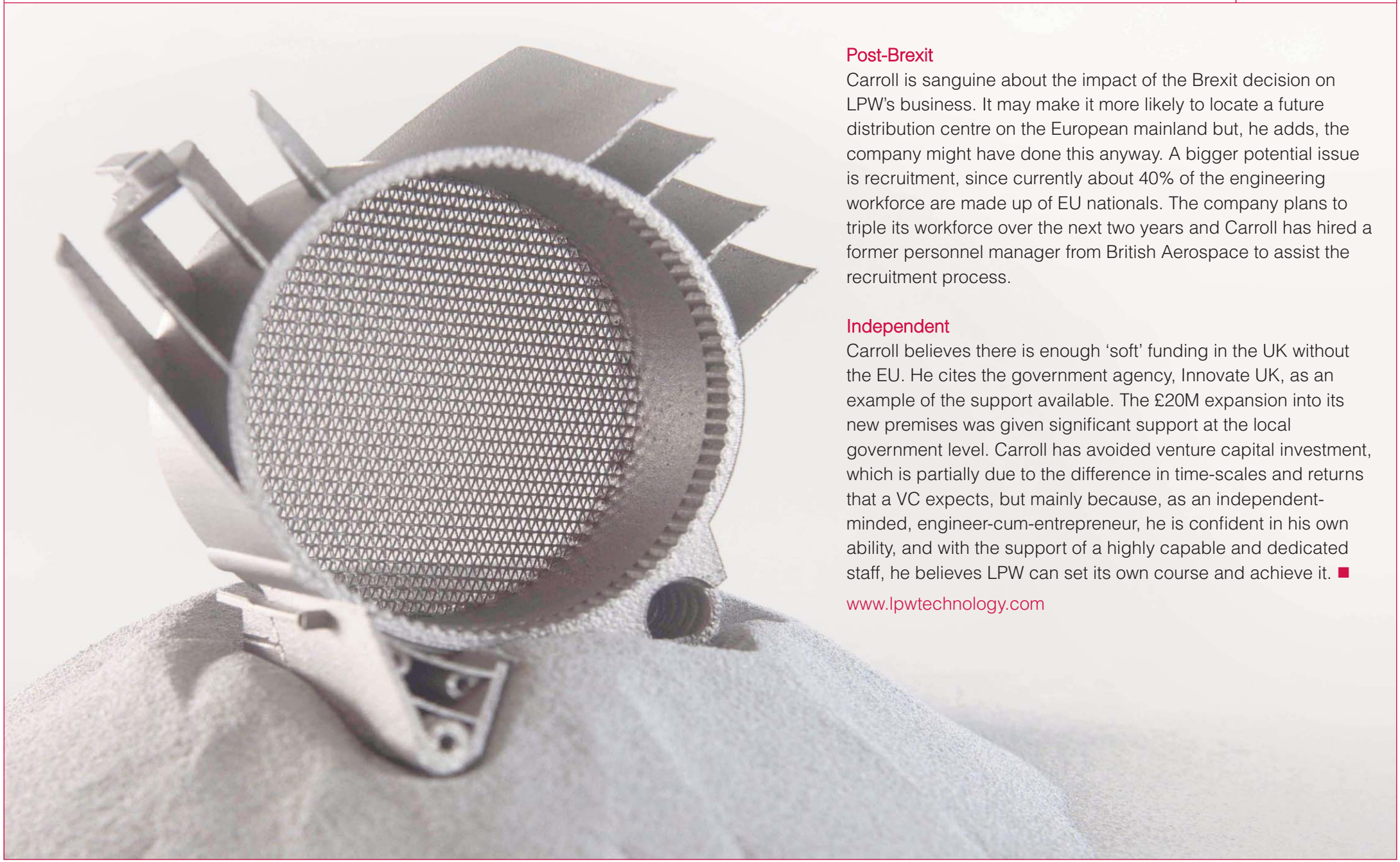
To meet rising demand for reliable metal powders, LPW moved into its current 22,000 sq ft facility in August 2014, but after only two years the company is planning to move again to a new facility which has over three times the available space. The new premises provides the capacity to increase metal powder supply, re-process powders to original specification and manufacture its own special alloys for customers - for example alloys of refractory metals such as molybdenum and niobium.

New supply dynamics

In the highly niche field of metal powders for 3D printing, the level of technical sophistication required to manufacture the exact powder for the job, tilts the balance from the OEM for the first time to the supplier. Normally the supplier is under pressure to reduce commodity costs, but at the current stage of market development the supplier becomes a genuine partner, working with the OEM for the best outcome, explains Carroll.

LPW Technology Ltd

Leader in 3D metal powder development and supply



Post-Brexit

Carroll is sanguine about the impact of the Brexit decision on LPW's business. It may make it more likely to locate a future distribution centre on the European mainland but, he adds, the company might have done this anyway. A bigger potential issue is recruitment, since currently about 40% of the engineering workforce are made up of EU nationals. The company plans to triple its workforce over the next two years and Carroll has hired a former personnel manager from British Aerospace to assist the recruitment process.

Independent

Carroll believes there is enough 'soft' funding in the UK without the EU. He cites the government agency, Innovate UK, as an example of the support available. The £20M expansion into its new premises was given significant support at the local government level. Carroll has avoided venture capital investment, which is partially due to the difference in time-scales and returns that a VC expects, but mainly because, as an independent-minded, engineer-cum-entrepreneur, he is confident in his own ability, and with the support of a highly capable and dedicated staff, he believes LPW can set its own course and achieve it. ■

www.lpwtechnology.com