Research paves the way for accurate manufacturing of complex parts for aerospace and car industries

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Producing strong, lightweight and complex parts for car manufacturing and the aerospace industry is set to become cheaper and more accurate thanks to a new technique developed by engineers from the University of Exeter. The research team has developed a new method for making three-dimensional aluminium composite parts by mixing a combination of relatively inexpensive powders.

Combining these elements causes a reaction which results in the production of particles that are 600 times smaller than the width of a human hair. Around 100 nanometres in size, the reaction uniformly distributes them through the material, making it very strong.

The process is based on the emerging technique of Selective Laser Manufacturing (SLM), in which laser manufactures complicated parts from metal powders, at the University's Centre for Additive Layer Manufacturing. The new technique has the potential to manufacture aluminium composite parts as pistons, drive shafts, suspension components, brake discs and almost any structural components of cars or aeroplanes. It also enables the production of lighter structural designs with innovative geometries leading to further reduce of the weight of products.

The team's latest research findings are published in the *Journal of* Alloys *and Compounds*.

Parts for cars and aeroplanes are widely made from aluminium, which is relatively light, with other reinforcement particles to make it stronger. The traditional methods, generally involved casting and mechanical alloying, can be inaccurate and expensive, especially when the part has a complex shape. Over the last decade, new SLM techniques have been developed, which enable parts with more complicated shapes to be produced. The new SLM techniques can be applied to manufacture aluminium composite parts from specific powder mixtures.

To carry out this new technique, the researchers use a laser to melt a mixture of powders, composed of aluminium and a reactive reinforcing material for example an iron oxide combination. A reaction between the powders results in the formation of new particles, which act as reinforcements and distribute evenly throughout the composite material.

This method allows parts with complex shapes to be easily produced. The new materials have very fine particles compared with other composites, making them more robust. The reaction between constituents releases energy, which also means materials can be produced at a higher rate using less power. This technique is significantly cheaper and more sustainable than other SLM methods which directly blend very fine powders to manufacture composites.

University of Exeter PhD student Sasan Dadbakhsh said: "This new development has great potential to make high performance parts for car manufacturing, the aerospace industry and potentially other industries. Additive layer manufacturing technologies are becoming increasingly accessible so this method could become a viable approach for manufacturing."

Dr Liang Hao of the University of Exeter added: "This advancement allows the rapid development of sustainable lightweight composite components. This particularly helps to save a considerable amount of

material, energy and cost for the production of one-off or small volume products."

Provided by University of Exeter