LIGHT
ADDING LESS SAVES MORE

Innovate UK
Technology Strategy Board

Warwick, 16th December 2014 - Q4 meeting at EOS UK Ltd

Consortium partners met on Tuesday December 16th 2014 for their fourth quarterly meeting at the Innovation Centre in Warwick, where partner EOS UK Ltd is based. EOS is the technology and market leader for design-driven, integrated e-Manufacturing solutions for AM.

The LIGHT project (full title *Inspiring New Design Freedoms and Light-Weight Solutions for Metal Additive Manufacturing*) is funded by the UK's innovation agency, the Technology Strategy Board. Potential improvements in the economy and performance of Metal Additive Manufacture (MAM) components will be investigated by the use of specialised software. The project has three main objectives:

- To demonstrate additive manufacturing (AM_) for three typical end-users by manufacturing light weight parts to demonstrate the benefits of AM utilising lattices and hollow structures.
- To develop an innovative CAD/CAM solution for lightweight product design for AM, including lattice structure design tools.
- To inspire new design freedoms for metal additive manufacturing to create advanced lightweight structures and products.

One of the key things needed in order to inspire new design freedoms to the manufacturing community is to obtain mechanical properties of lattice structures for future product engineering. Experimental tests on sample parts has produced material properties, which can be used for the indirect FEA solution, allowing more efficient FEA based upon simulating lattices as a bulk material rather than the computationally intensive (and less accurate) simulation of the 3D lattice geometry directly.

Over the past three months a more extensive set of experiments have been performed (see image), which will also continue in the next quarter. The experiments have been performed in Maraging Steel and the data is directly applicable to the first demonstrator, which is the airbrake door hinge from Bloodhound SSC. The other two demonstrators to follow are one using Inconel for the HiETA Technologies thrust nozzle demonstrator and Magna Parva's earth re-entry capsule demonstrator in Ti64. The end-users will use the obtained measurement data in parallel FEA studies to confirm the validity of the indirect FEA route and optimise their demonstrator part designs for the second phase of the project.

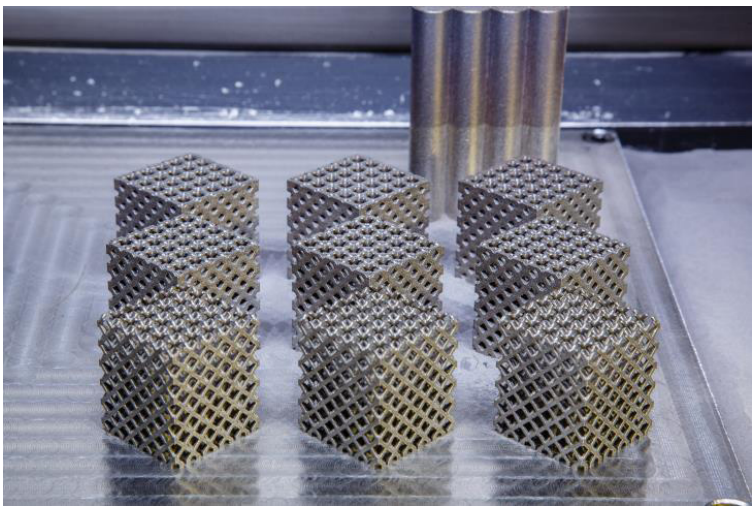

Figure 1: Sample parts with different volume fractions manufactured in Maraging Steel

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Software developed in parallel to the experiments is used to create the different sample geometries, where unit cell design and volume fraction are the primary design variables. Two unit cell designs have been used in compression testing and interestingly show different failure methods. One shows a regular compression of the lattice structure, perfect for energy absorption, one of the key requirements for the earth re-entry capsule for instance. The other unit cell showed a different failure mechanism, a brittle failure of the structure, see image, which is undesirable. Other interesting results show the clear influence of the volume fraction on the mechanical strength: below a certain value the manufacturing defects start to dominate the failure mechanism of the lattice. The next quarter will see the completion of the sample experiments and at that time a full set of conclusions can be drawn from the measurement data.

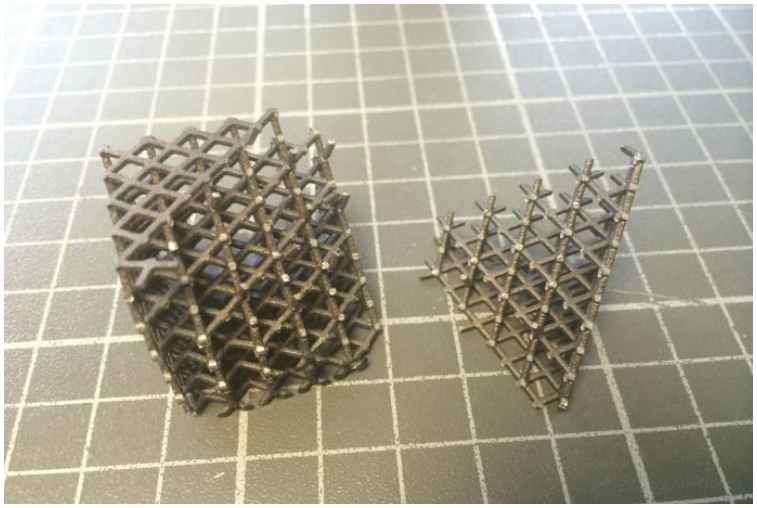

Figure 2: Brittle failure mode of the lattice structure

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For more information visit the website *www.light-project.co.uk* or send an email to info@light-project.co.uk.

Acknowledgements
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