

## Ampal and Loewy Institute complete Phase I project to optimise Al powder for Additive Manufacturing

Ampal, Inc., Palmerton, Pennsylvania, USA, a fully-owned subsidiary of U.S. Metal Powders, Inc., and Lehigh University's Loewy Institute, Bethlehem, Pennsylvania, USA, have completed a Phase I Ben Franklin project on the 'Optimization of Aluminium Alloy AA6061 powder for Selective Laser Melting Process'.

U.S. Metal Powders, Inc. has been supplying aluminium alloy powders produced by air and inert gas atomisation to the Additive Manufacturing industry for several years. The demand for aluminium alloys has been increasing, and AA6061 (Al-Mg-Si) is one of the most sought after alloy systems in the AM industry, with applications in several industries including the automotive and aerospace sectors.

However, the production of sound parts using AA6061 alloy powder in Laser Beam Powder Bed Fusion (PBF-LB), or Selective Laser Melting (SLM), has been challenging due to the powder's low flowability and high thermal conductivity.

As part of the project, AA6061 inert gas atomised aluminium powder grades were used to build 10 mm x 10 mm x 10 mm solid cube samples using lasers ranging from 200–400 W. The parts were built in a Renishaw AM400 unit with a reduced build volume (RBV) unit installed; this

deposits powder using a mechanical feed piston system.

Several sets of sample parts were built using a Renishaw AM400 with variations in laser power, point distance, and exposure time. The density of each sample was determined using the Archimedes method and light optical microscopy. Metallographic analysis determined optimum build parameters, and characterised the meltpool boundaries (MPB) and porosity formed in the PBF-LB process.

Scanning Electron Microscopy (SEM) revealed a fine microstructure and precipitate formation through natural ageing. Micro hardness tests showed promising results comparable to previous literature, leading to high mechanical properties.

AA6061 parts were built to near-net density by the PBF-LB process at optimum conditions. The optimised

process parameters yielded around 98% density for the alloy, with porosities reduced to the minimum by modifying processing parameters.

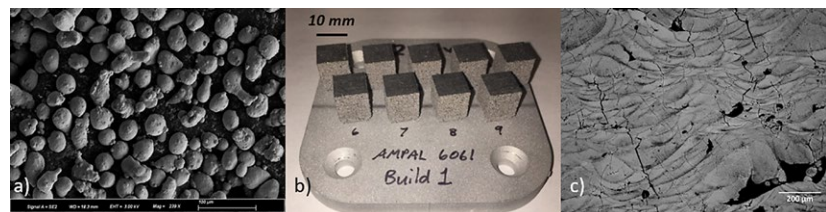
The Phase 2 project will target the optimisation of heat treated properties, further density improvement, and crack reduction to achieve a commercially viable PBF-LB process to make parts using optimised AA6061 alloy powder and processing parameters.

U.S. Metal Powders, Inc. is the largest aluminium powder producer in North America and global producer of aluminium and aluminium alloy powders, offering a full-range of coarse to fine aluminium powders from its manufacturing facilities Ampal, Inc., USA and Poudres Hermillon SARL, France.

Ben Franklin Technology Partners is an initiative of the Pennsylvania Department of Community and Economic Development and is funded by the Ben Franklin Technology Development Authority.

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AA6061 alloy as (a) powder, (b) as-built components, and (c) as shown in a light optical micrograph (Courtesy US Metal Powders Inc)

