Laser powder-bed fusion of aluminium based composites for enhanced tribological performance

Peifeng Li[1], Fang Xu[1], Xianghui Hou[1], Adam Clare[2,3], Nesma Aboulkhair[4]

[1] Faculty of Engineering, University of Nottingham, University Park, Nottingham, NG7 2RD, UK

[2] Advanced Component Engineering Laboratory (ACEL), University of Nottingham, Nottingham, NG7 2RD, United Kingdom

[3] Department of Mechanical, Materials and Manufacturing Engineering, Faculty of Science and Engineering, University of Nottingham China, 199 Taikang East Road, University Park, Ningbo, 315100, China

[4] Centre for Additive Manufacturing, Advanced Manufacturing Building, University of Nottingham, NG8 1BB, UK

Peifeng.Li@nottingham.ac.uk

Laser powder-bed fusion (L-PBF), is a metal additive manufacturing (AM) method that selectively melts and fuses metal powder using a high-power density laser beam. Aluminium-based composites have been developed to meet the modern demand for light and energy-efficient materials, thanks to their attractive properties. These materials have tremendous potential in various sectors, such as the automotive industry, hence the global interest in studying their properties when coupled with the unmatched capabilities offered by L-PBF. Studies on the tribological behaviour of L-PBF Al-based composites are, however, limited, despite their prospects in wear-related automotive parts, e.g. cylinder blocks and pistons. The present study used L-PBF to fabricate samples from Al- WS_2 composite powder. The process-structure-property relationship is presented. The samples were characterised for metallurgical and mechanical properties, including hardness mapping. Furthermore, the tribological properties of the L-PBF parts were compared to the conventional spark plasma sintered (SPS) samples, which were consolidated from the same composite powder. The study reports enhanced tribological behaviour for the samples produced using L-PBF, which opens up new opportunities for this material-process combination in the field of manufacture for green tribological applications.