OP-13-644

Thursday, May 12, 2011, 09:25-09:45 am
Room: Karam 5

# NEAR INFRARED SPECTROSCOPY CROSS-CORRELATION OF SURFACE ROUGHNESS AND MECHANICAL PROPERTIES FOR SELECTIVE LASER SINTERED (SLS) PARTS BUILT AT DIFFERENT LASER SCAN SPEEDS

M. Beard[a,*], O. Ghita[a]

[a] *College of Engineering, Mathematics and Physical Sciences, University of Exeter, Exeter, EX4 4QF UK*

**Corresponding author: m.a.beard@ex.ac.uk*

Selective laser sintering (SLS) is a manufacturing method by which polymeric powder is sintered layer-by-layer in unique, complex structures. The sintering process and the properties of the final parts are defined by a combination of parameters such as: laser scan speed, laser power, laser spot size and overlap of scan vectors. Although the technology is becoming more and more attractive to various manufacturing sectors, due to parts functionalities and savings in material consumption, the sintering process is still difficult to understand, characterise and optimise. To date there is no technique available to monitor on-line or off-line, non-destructively any of the SLS parameters and to relate them back to part's property.

This paper reports on the use of Near IR (NIR) spectroscopy to successfully monitor two of the most important sintering parameters: laser scan speed and laser power. Components were manufactured varying the laser energy density by using different laser powers and laser scan speeds. Using a reflectance optical fibre probe, near infrared spectra from the surface of each part were recorded and the surface topology was employed to investigate the samples roughness. The use of principal component analysis revealed good cross-validation graphs between the true laser scan speed or laser power and the values predicted by NIR. Changes in NIR spectra have also proved to correlate with the surface finish and mechanical properties of SLS components. Therefore, NIR spectroscopy could be used as a monitoring tool to predict the laser scan speed or power used for manufacturing the SLS parts as well as their mechanical performance.