Detection of unmelted powder in additive manufactured components using computer tomography

Ahmed Tawfik1, Radu Racasan1, Paul Bills1, Liam Blunt1

1EPSRC Future Advanced Metrology Hub, University of Huddersfield, Huddersfield, United Kingdom

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Additive manufacturing (AM) is recognized as a core technology for producing advanced high value components. The possibility of producing complex and individually modified components as well as prototypes gives additive manufacturing a substantial advantage over conventional subtractive machining. One of the current barriers for most industries in implementing AM is the lack of build repeatability and a deficit in quality assurance standards. The mechanical properties of the components depend critically on the density achieved therefore defect/porosity analysis must be carried out to verify the components’ integrity and viability.

This paper presents a methodology for differentiating between unmelted powder and defects/pores in additive manufactured components using computer tomography thus allowing the detection of pores even when they are “filled” with unmelted powder. The powder used was Ti6AL4V with a grain size of 45-100µm, typically employed with Arcam electron beam melting (EBM) machines. The samples consisted of a plastic test tube filled with powder and a known volume small plastic particles that were placed inside acting as pores/defects. A Nikon XTH 225 industrial CT was used to measure the samples to detect the pores/defects locations and volumes.

To reduce the number of process variables, the measurement parameters, such as filament current, acceleration voltage and X-ray filtering material and thickness are kept constant. VgStudio Max 3.0(Volume Graphics, Germany) software package was used for data processing, surface determination and defects/ porosity analysis. The impact of surface determination on the results, repeatability and accuracy are discussed. The main focus of the study is exploring the optimum methods to enhance the detection capability of pores/defects filled with powder using computer tomography.