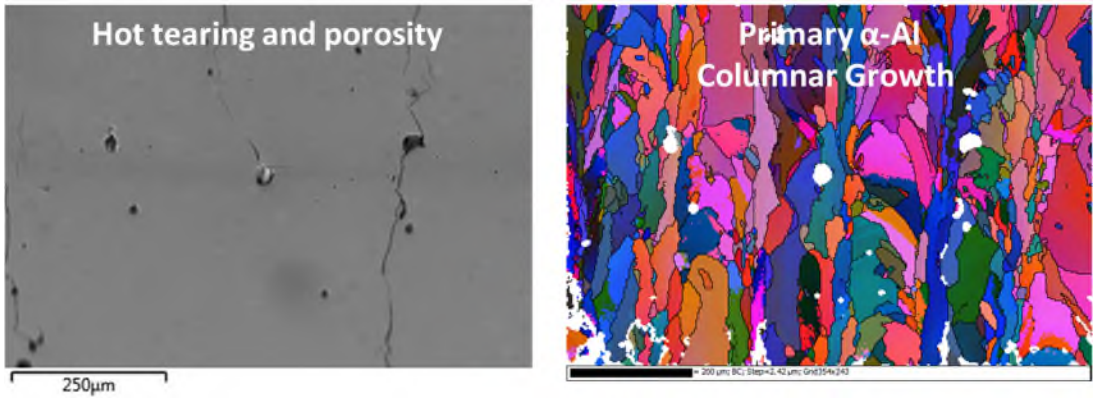
Microstructural Simulation for Additive Manufacturing (AM) of Alloys

Dr. Hiren Kotadia and Dr. Greg Gibbons

Warwick Manufacturing Group, University of Warwick, Coventry, CV4 7AL, UK.

3DP/AM is rapidly developing as a fundamentally new approach to making objects for structural and functional applications. In technical terms, AM offers a number of potential advantages over traditional manufacturing techniques in terms of manufacturing complex objects unachievable through conventional manufacturing and increasing the yield while minimising waste and cost and potentially expediting the passage from concept to components stage. This transformational technology has the potential to revolutionise some areas of industry such as automotive, aerospace, electronics and medical. This particularly applies if it can be used for engineering applications at low cost, reduced cycle time with enhanced performance. However, little is known about chemistry-process-microstructure-property-performance correlation.

An efficient combination of finite element, phase-field modelling could potentially capture the predictive AM microstructural evolution. New computation tools are also needed to simulate and predict processing parameters effects on microstructure-property, combining with Real-time In-line Process Control. The understanding of microstructure formation and the know-how to control and tailored them is vital in developing future AM technologies for various metallic systems.



As example: AM of Al alloys shown large hot-cracks and porosity and columnar primary α-Al grains, the objective of project to eliminate cracks and defects.

.