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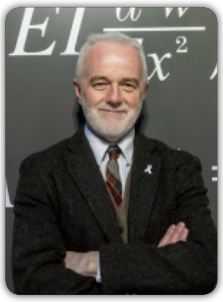

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Rapid alloy prototyping for steels

Steel is the most widely used structural material in the world. Innovations in alloy development contribute to advances in key manufacturing sectors including automotive, packaging, defence and construction. Globally the development of new steel and coating alloys is a slow and iterative process involving significant business risk and expensive trials of many 100s of tonnes. This paper describes a high throughput approach to trials where substantial numbers of small scale samples will be prepared and their properties and processability tested and modelled using state of the art imaging, computational modelling and mechanical testing. This effort is a new partnership between Swansea University, Warwick University and Tata Steel. The research direction is informed, but not limited, by the pull from customer requirements, future product projections and by existing constraints introduced by processing asset limitations and residual elements contained within scrap, an essential component of all primary steel. This radical virtual factory approach will be integrated into a scale up activity enabling the simultaneous solution of new materials invention and processing. This research has the potential of transforming the steel innovation cycle and reducing screening times by a factor of up to 100 creating a vibrant 21st century steel manufacturing industry, feeding a diverse supply chain operating in multiple sectors.

Recent Publications

1. Lavery N P, Mehraban S, Pleydell Pearce C, Brown S G R, Jarvis D J, Voice W and Brunnock M (2015) Combinatorial development and high throughput materials characterisation of steels. Ironmaking & Steelmaking 42(10):727-733.
2. Calvo Dahlborg M and Brown S G R (2017) Hume Rothery for HEA classification and self-organizing map for phases and properties prediction. Journal of Alloys and Compounds 724:353-364.
3. Yusenko Kirill V, Riva Sephira, Crichton Wilson A, Spektor Kristina, Bykova Elena, Pakhomova Anna, Tudball Adam, Kupenko Ilya, Rohrbach Arno, Klemme Stephan, Mazzali Francesco, Margadonna Serena, Lavery Nicholas P and Brown Stephen G R (2018) High-pressure high-temperature tailoring of high entropy alloys for extreme environments. Journal of Alloys and Compounds 738:491-500.
4. Lavery N P, Cherry J, Mehmood S, Davies H, Girling B, Sackett E, Brown S G R and Sienz J (2017) Effects of hot isostatic pressing on the elastic modulus and tensile properties of 316L parts made by powder bed laser fusion. Materials Science and Engineering: A 693:186-213.
5. Mindt H W, Megahed M, Lavery N P, Holmes M A and Brown S G R (2016) Powder bed layer characteristics: the overseen first-order process input. Metallurgical and Materials Transactions A 47(8):3811-3822.

Biography

Stephen G R Brown is Head of the College of Engineering at Swansea University, Wales, UK. His current research work involves modelling and experimentation for additive manufacturing, alloy discovery and high-throughput testing for high entropy alloys and steels.

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