# Inaugural Meeting

# The Ridge

# University of Sheffield

# 3 September 2015

# Programme

# *Designing Alloys for Resource Efficiency- A Manufacturing Approach*

**This is an open meeting and anything discussed here is to be considered 'in the public domain'.**

**10.00 - 10.30** **Registration and coffee**

**10.30 – 11.00** **Welcome & overview**

**Professor Mark Rainforth**

Professor of Materials Engineering, Department of Materials Science and Engineering, The University of Sheffield.

**11.00 – 12.45** **Presentations**

**"A review of design cases for plasticity in titanium, hardening in magnesium and corrosion resistance in steel "**

**Dr Pedro Rivera**

Assistant Director of Research, SKF University Technology Centre, University of Cambridge.

**"Design of Alloys for Emerging Processes"**

**Professor Iain Todd**

Royal Academy of Engineering /GKN Chair Additive Manufacturing and Advanced Structural Metallics, University of Sheffield

**“Ordering, Hydrogen and Cracking in alpha-Ti alloys”**

**Professor David Dye**
Professor of Metallurgy, Dept. of Materials, Imperial College London.

## 13.00 – 14.00 LUNCH

## 14.00 – 15.15 Presentations

**“Microstructural sensitivity of fatigue crack nucleation in two polycrystal alloys”**

**Prof Fionn Dunne**

Professor of Micromechanics, Imperial College London

**"How can quantum mechanics help our quest for resource efficiency?"**

**Professor Tony Paxton**

Professor of Computational Materials Science, King's College London.

## 15.15 – 15.30 Tea and coffee

## 15.30 – 16.20 Presentations

**“Sustainable steelmaking - resource efficient processes and new advanced steels”**

**Professor Claire Davis**

Tata Steel Professor in Thermomechanical Processing, University of Warwick

**‘Aluminium alloy composition optimisation for Wire + Arc Additive Manufacture”**

**Professor Stewart Williams**

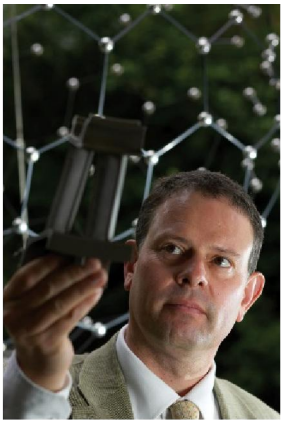
Professor of Welding Science and Engineering, Cranfield University.

## 16.20 – 17.20 Q&A and open discussion

## 17.30 Poster session and drinks

# *Speakers*

**Welcome & overview - Professor Mark Rainforth**



After obtaining a 1st Class Honours degree from the University of Sheffield, Mark Rainforth initially followed an industrial career. He later joined the Department of Materials Science & Engineering in Sheffield from the University of Leeds in 1989 and rapidly established state-of-the-art facilities in electron microscopy and tribology. He is co-author of the book `Ceramic Microstructures´ with W E Lee, a winner of the Rosenhain Medal of the IoM3 and has recently finished his term as President of the Royal Microscopical Society.

His research centres on the high resolution characterisation of microstructures, in particular interfaces and surfaces. His research programmes are broadly based and cover metals, ceramics and coatings.

**“A review of design cases for plasticity in titanium, hardening in magnesium and corrosion resistance in steel “ - Dr Pedro Rivera**

Dr Pedro Rivera’s research work focuses on developing new principles in physical metallurgy and microstructural modelling to conceive novel technologies, which will hopefully lead to a better quality of life from the point of view of engineering design and the environment.

**"Design of Alloys for Emerging Processes" - Professor Iain Todd**

Iain Todd joined the Department of Materials Science & Engineering, University of Sheffield, in 2003 from the National Centre for Metals Research (CENIM) in Madrid, Spain. He obtained both his BEng and PhD at Sheffield and has held postdoctoral appointments at Sheffield, the Netherlands Institute for Metals Research (NIMR) at TU-Delft and CENIM in Madrid.

Presently the main focus of his research lies in new and emerging metallic materials and net shape manufacture and behaviour of complex materials and components.

**“Ordering, Hydrogen and Cracking in alpha-Ti alloys” - Professor David Dye**

David Dye’s research interests focus on the micromechanics of jet engine, aircraft and reactor materials, particularly superalloys, titanium and zirconium. His research group works on problems across the life-cycle from alloy design to processing to fatigue and failure.

A lot of the work involves advanced TEM techniques, complementing work at neutron and synchrotron major facilities like ISIS, Diamond, ESRF and SNS. A developing focus is the use of in situ microbeam Laue synchrotron diffraction to interrogate deformation behaviour at the nanoscale.

Shear processes like twinning, hydriding and stress-induced martensites are a particular interest and is the topic of his EPSRC Leadership Fellowship. In this context, he also works on TWIP steels, shape memory alloys and bcc titanium.

The Impact of this research is the prospect of delivering safer, lower emissions in air transport and energy systems.

**“Microstructural sensitivity of fatigue crack nucleation in two polycrystal alloys”**

**Professor Fionn Dunne**

Fionn Dunne is Chair in Micromechanics and holds the Royal Academy of Engineering/Rolls-Royce Research Chair at Imperial. Current research is in the fundamentals of deformation and failure particularly relating to hcp polycrystal and Ni alloys and includes computational crystal plasticity, discrete dislocation plasticity, micro-deformation, fatigue crack nucleation, texture and dislocation structure development and polycrystal sonics for NDE. He leads the EPSRC programme grant Heterogeneous Mechanics in Hexagonal Alloys across Length and Time Scales, directs the Imperial Rolls-Royce Nuclear University Technology Centre and Co-Directs the AVIC-BIAM Centre for Materials.

**"How can quantum mechanics help our quest for resource efficiency?"**

**Professor Tony Paxton**

Before joining King's College London Tony was a Professor of Theory and Modelling in Condensed Matter and Director of Research in the Atomistic Simulation Centre at Queen's University Belfast. He has a BMet from Sheffield University (1984) and DPhil from Oxford (1987). He worked at Max Planck Institut fuer Festkoerperforschung (1987-1989), SRI International, Menlo Park California (1989-1993) and University of Oxford, Department of Materials (1993-1995). From 1995 to 2013 he was at Queen's University Belfast and is currently attached to the Fraunhofer Institute for Mechanics of Materials (IWM) in Freiburg. He is a Visiting Professor in the Department of Materials at Imperial College London and Honorary Professor of Physics at Queen's University Belfast.

His research interests are in nanoscale and microscale modelling of structure property relations in structural and functional materials. He is also interested in atomistic simulation of water and chemical processes in aqueous solution, both catalysis and corrosion.

**“Sustainable steelmaking - resource efficient processes and new advanced steels”**

**Professor Claire Davis**

Claire Davis was appointed as the Tata Steel Professor of Thermo-Mechanical Processing in WMG at the University of Warwick in September 2014. She was previously the Professor of Ferrous Metallurgy at the University of Birmingham. Her research interests are on the development of microstructure during processing and the relationships between microstructure and properties (both physical and mechanical) in steels. She also works on the non-destructive evaluation of microstructure and defects in steel.

**‘Aluminium alloy composition optimisation for Wire + Arc Additive Manufacture”**

**Professor Stewart Williams**

Stewart Williams spent five years at Edinburgh Instruments building lasers and laser systems. In 1987 he moved to the Advanced Technology Centre of BAE Systems where he ran a group whose main area of research was laser processing of aerospace materials. Currently he is Director of the Welding Engineering and Laser Processing Centre (WELP) at Cranfield University. The main areas of research at the WELP are additive manufacturing, laser and laser-arc hybrid welding, weld metal engineering and residual stress control/management.

# *Delegates*

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| Prof Richard Dashwood | University of Warwick |
| Prof David Rugg | Rolls-Royce plc |
| Dr Nick Champion | Primetals Technologies Limited |
| Matthew Thomas | Timet UK Ltd |
| Dr David Hanlon | Tata Steel |
| Prof Jesus Talamantes-Silva | Sheffield Forgemasters |
| Prof Mark van Schilfgaarde | Kings College London |
| Prof Brad Wynne | University of Sheffield |
| Dr Russell Goodall | University of Sheffield |
| Dr Lefteri Andritsos | Kings College London |
| Dr Enrique Galindo-Nava | University of Cambridge |
| Dr Jun Jiang | Imperial College |
| Dikai Guan | University of Sheffield |
| Junheng Gao | University of Sheffield |
| Sam Tammas-Williams | University of Sheffield |
| Guy Skinner | Kings College London |
| Alexander Knowles | Imperial College |
| Jean Simpson | University of Sheffield |
| Andrew Patterson | University of Sheffield |
| Gavin Baxter | Rolls-Royce plc |
| Haiyun Wang | University of Sheffield |
| Righdan Namus | University of Sheffield |
| Dr Francis Sweeney | University of Sheffield |
| Dr Jo Sharp | University of Sheffield |
| Feng Qian | University of Sheffield |
| Peng Gong | University of Sheffield |
| Ben Thomas | University of Sheffield |
| Affaan Moosa | University of Sheffield |

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| Andrew Dunsmore | Tata Steel |
| Moataz Attallah | University of Birmingham |
| Dr Jon Willmott | University of Sheffield |
| Nick Boone | University of Sheffield |
| Charlotte Boig | University of Sheffield |
| Dion Vaughan | Metalysis Ltd |
| Zuheir Khulief | University of Sheffield |
| Haotian Nan | University of Sheffield |
| Nader Khan | Metalysis Ltd |
| Iain Flint | University of Cambridge |
| Jacob Pope | University of Sheffield |
| Ian Edmonds | Rolls-Royce plc |
| Neil Harrison | University of Sheffield |
| Yuhe Huang | University of Sheffield |
| Norhuda Hidayah Nordin | University of Sheffield |
| Gautam Anand | University of Sheffield |
| John Hinton | Primetals Technologies Limited |
| Masoumeh Faraji | Sheffield Hallam University |
| Dr. Melchiorre Conti | Metalysis Ltd |
| Peter Morris | Beta Technology |
| Dr Kamran Mumtaz | University of Sheffield |
| Matthew Green | Tata Steel |
| Professor Arnoldo Bedolla | Universidad Michoacana De San Nicola´ s De Hidalgo |