

Dr Martin Strangwood PhD, CEng, MIMMM

Senior Lecturer

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About

Martin Strangwood is a senior lecturer and runs the Phase Transformations and Microstructural Modelling Group. His research interests lie in the quantification of structures and properties for a range of materials, relating these to processing conditions, composition and eventual properties.

The physical relationships established are then used with thermodynamic and kinetic models to optimise processing and composition combinations. Much work has been carried out on various grades of steel, although aluminium-, titanium-, nickel- and copper-based alloys also feature. Processing steps investigated include casting (continuous, ingot and ESR), reheating, rolling, forging, heat treatment and welding.

As well as structural metallic alloys various composites, polymers and ceramics have been studied. The polymers and polymer matrix composite applications are often related to sports such as golf, cricket, cycling, hockey, rowing and running. He has been invited to give many presentations on the use of materials in sports equipment. He has been consulted by a number of sports bodies.

He has published over 200 refereed papers and contributed 10 book chapters.

Qualifications

- PhD, Cambridge, 1987
- MA Cambridge, 1988

Biography

Martin Strangwood gained his BA (later MA) in 1984 and his PhD in 1988 both from Cambridge University. His PhD was on Prediction and Assessment of Weldmetal Microstructures, an area that he continued for the following 3 years whilst at AEA Harwell working on a variety of projects including the Sizewell B safety case.

During his time at Harwell he also acted as a tutor for the Open University. He joined the School of Metallurgy and Materials at Birmingham in 1990 and has since supervised 53 PhDs and 8 Masters projects

Teaching

- PGA104 Materials in Golf
- PGA204 Equipment Technology
- MT2 MEDb Materials Engineering Design
- MT3 COMa Control of Microstructure
- MT3 HPmb High Performance Aerospace Materials
- MT3 AMSb Advanced Materials in Sports
- MT3 SLRb Sports Literature Reviews

Postgraduate supervision

- D Ranga Stick-Ball-Surface Interactions in Hockey
- C Slater Static and Dynamic Deformation of Carbon Fibre Composites in Golf Shafts
- J L Huang Modelling Porosity Formation in EBWd Titanium-based Alloys
- D Routledge Joining Process Optimisation for SMA-based Actuators
- A J Davis Novel Composite Structures for Watersports Equipment
- H Bayati Microstructural Features Contributing to Running Crack Arrest
- A Kundu Effects of Combined Thermal and Mechanical Processing on Bimodal Grain Development
- Xi Liu Quantification of Multi-phase Complex Ferrous Microstructures

- G Roberts Use of KAM in Characterising Deformation in Steel Rails
- R Punch Characterisation and Modelling of High Strength, High Toughness Strip Steel
- J-P Tovee The Role of Precipitates on the Bauschinger Effect in High Strength Steel Pipes
- G Carlisle Stiffness Variation Effects along Composite Hockey Sticks
- P McNutt Development of Rapid Build DLF in Aerospace Alloys
- J M Ranalli Thermal and Irradiation Effects on the Structure and Properties of Duplex Steel Overlays
- C Karl Oxygen Ingress Rates and Effects on Fatigue in Ti-based Alloys
- Guowei Zhang Relationship between HAZ and Weldmetal Structure across the Fusion Boundary in Al-based Alloys
- Lei Zhou Fundamentals of Electromagnetic Response in Precipitation Hardened Systems
- Yin-Len Chiu Development of Amorphous Brazes for Golf Drivers
- J Roberts Characterisation and Modelling of Kickpoints in Composite Golf Shafts
- Du Jinlong Interaction of Particle Size and Grain Size on DBTT in High Strength Steels
- R Dally Modelling of Segregation and Microstructures in ESR Ingots

Research

RESEARCH THEMES

- Optimisation of Steel Processing and Composition
- Quantification of Microstructure
- Non-destructive Microstructure Determination
- Chemical Segregation during Processing
- Dynamic Materials Properties for Sports Applications
- Shape Memory Alloys

RESEARCH ACTIVITY

- Characterising as-cast steels with a range of compositions from various casting processes in terms of spatial variation of composition and microstructure (optical and scanning electron microscopy)
- Simulation of various processing both thermally and mechanically before quantification of the effects of these on microstructure and properties.
- Apply new mathematical algorithms to digitised images to more accurately determine microstructures over larger scales.
- Relate signals from electromagnetic sensors to microstructures to establish methods for non-destructively monitoring microstructure.
- Construct composite panels and structures by vacuum bagging and hot press, then characterise their structure and properties using testing machines, drop tests and gas cannon testing.

Publications

Yin, W., Peyton, A. J., Strangwood, M. & Davis, C. L., (2007), Exploring the Relationship between Ferrite Fraction and Morphology and the Electromagnetic Properties of Steel, **J. Mat. Sci.**, 42: 6854-6861.

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Strangwood, M., (2008), Sporty Polymers, **Materials World**, 16(6): 26-27.

Davis, C. L., Strangwood, M., Potter, M., Dixon, S. & Morris, P. F., (2008), Prediction of Elastic Modulus + Anisotropy using X-ray and Electron Backscattered Diffraction Texture Quantification and Ultrasonic (Electromagnetic Acoustic Transducer) Measurements in Aluminium Sheets, **Metall. Mater. Trans**, 39A(3): 679-687

Chakrabarti, D., Davis, C. L. & Strangwood, M., (2008), Development of Bimodal Grain Structures in Nb-containing High Strength Low Alloy Steels during Slab Reheating, **Metall. Mater. Trans**, 39A(8): 1963-1977.

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Davis, C. L. & Strangwood, M., (2009), Segregation Behaviour in Nb-microalloyed Steels, **Mat. Sci. Tech.**, 25(9): 1126-1133.

Kundu, A., Davis, C. L. & Strangwood, M., (2010), Modeling of Grain Size Distributions during Single Hit Deformation of a Nb-containing Steel, **Metall. Mater. Trans A**, 41A(4): 994-1002.

Hao, X.J., Yin, W., Strangwood, M., Peyton, A. J., Morris, P. F. & Davis, C. L., (2010), Modelling the Electromagnetic Response of Two-phase Steel Microstructures, **NDT & E International**, 43: 305-315.

Attallah, M.M., Strangwood, M. & Davis, C. L., (2010), Influence of the heating rate on the initiation of primary recrystallization on a deformed Al-Mg alloy, **Scripta Mater.**,

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Ranga, D. & Strangwood, M., (2010), Finite Element Modelling of the Quasi-static and Dynamic Behaviour of Solid Sports Balls based on Component Material Properties, **Procedia Engineering**, 2(2): 3287-3292.

Kostrzyhev, A. G., Punch, R. B., Strangwood, M. & Davis, C. L., (2011), Acoustic Emission Monitoring of Split Formation during Charpy Impact Testing of High Strength Steel, accepted for publication in **Mat. Sci Tech.**

Strangwood, M., (2007), Computational Modelling of Materials for Sports Equipment, in Subic, A. (ed) **Materials in Sports Equipment vol 2**, Cambridge: Woodhead Publishing Ltd., pp 3-34.

Wallace, E. S., Kingston, K., Strangwood, M. & Kenny, I., (2008), Golf Science, in Reilly, T. (ed) **Science and Sports: Bridging the Gap**, Maastricht: Shaker Publishing, Maastricht, pp 94-106.

Widmann, H. G., Davis, A. J., Otto, S. R. & Strangwood, M., (2007), Advanced Materials in Golf Driver Head Design, in Fuss, F. K., Subic, A. & Ujihashi, S. (eds) **The Impact of Technology on Sport II**, London: Taylor & Francis, pp 247-252.

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Expertise

Analysis of materials properties (strength, stiffness, fracture and fatigue) related to their composition and processing (casting, forging, rolling, welding); selection of materials and manufacturing routes for applications in many industries, particularly sports and aerospace

Languages and other information

Martin's laboratory includes a gas cannon for testing impacts at up to 200 mph.

Media experience

Martin is an experienced media comentator having been interviewed for publications ranging from Good Housekeeping to the Sunday Times. As well as covering his own research areas he has been interviewed about a wide range of issues in engineering and materials science.

Alternative contact number available for this expert: **[contact the press office \(http://www.birmingham.ac.uk/news/contacts/index.aspx\)](http://www.birmingham.ac.uk/news/contacts/index.aspx)**