

The Strategic University Steel Technology and Innovation Network Presents

Task 9: Product development, late stage definition and integration

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The logo for the SUSTAIN research hub. It features the word "SUSTAIN" in a bold, white, sans-serif font. The letter "T" is replaced by a white, stylized infinity symbol or a three-lobed knot. The background of the slide is a dark green, geometric pattern of interlocking lines that create a sense of depth and perspective, resembling a complex steel structure or a tunnel.

Future Steel Manufacturing Research Hub

**UK
RI**

Engineering and
Physical Sciences
Research Council



The
University
Of
Sheffield.

Names and Organisations

- Professors WM Rainforth, EJ Palmiere
 - The University of Sheffield
- Dr M Strangwood
 - Birmingham University



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Introduction to Project

- Improved product uniformity along the length and across the section (chemical analysis, microstructural and mechanical property homogeneity & repeatability)
- Microstructural evolution during hot deformation to enhance mechanical properties or improve homogeneity
- Novel/innovative heat treatment to reduce heat treatment cost, with/without alloy design
- Achieving fine grain size without microalloy elements; higher strength product.

Aims and Impact

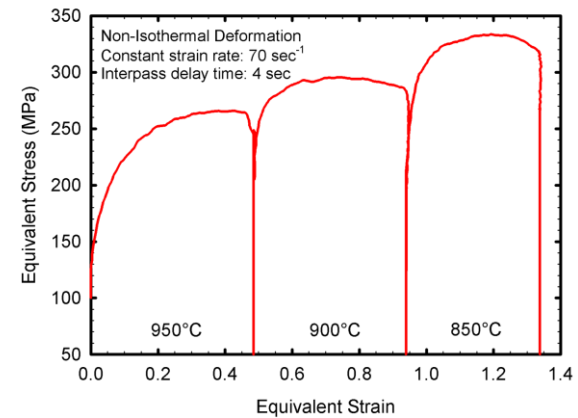
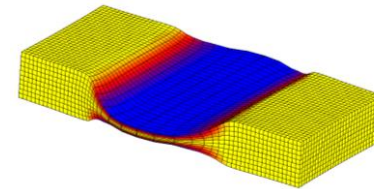
• Aims

- Understand thermomechanical process conditions on conditioning austenite to optimise transformed microstructure
- Provide a new approach to understanding the relationship between steel composition and the transformation mechanisms and kinetics from austenite
- Provide precise mechanistic understanding of the role of individual elements in transformation
- Develop a definitive statement on the effect of prior austenite state on transformation kinetics
- Develop an understanding of memory effects in reverse transformation
- Correlate the behaviour observed in model steels with commercial steels of interest to each steel producer

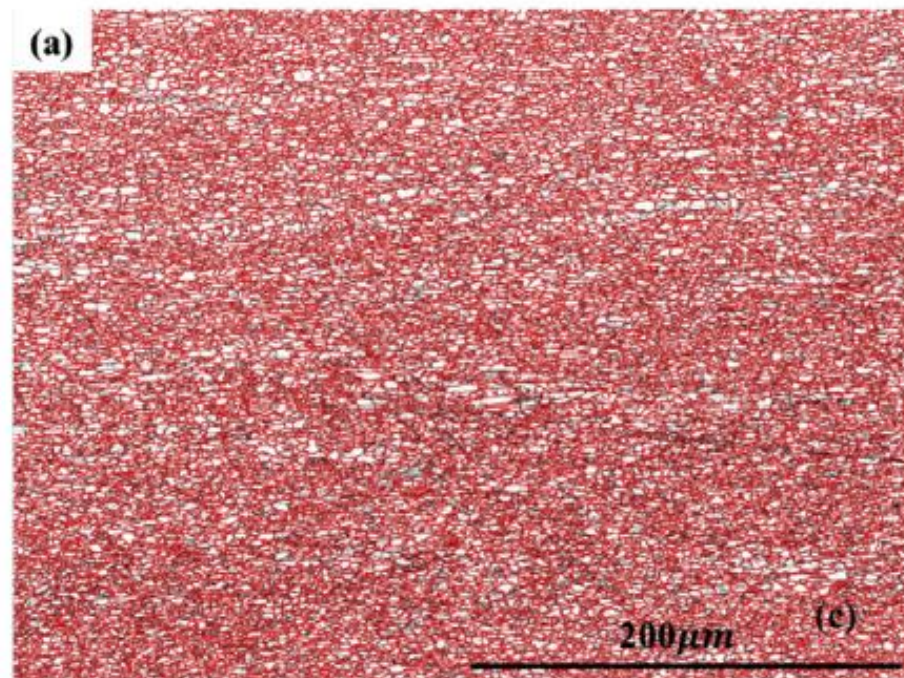
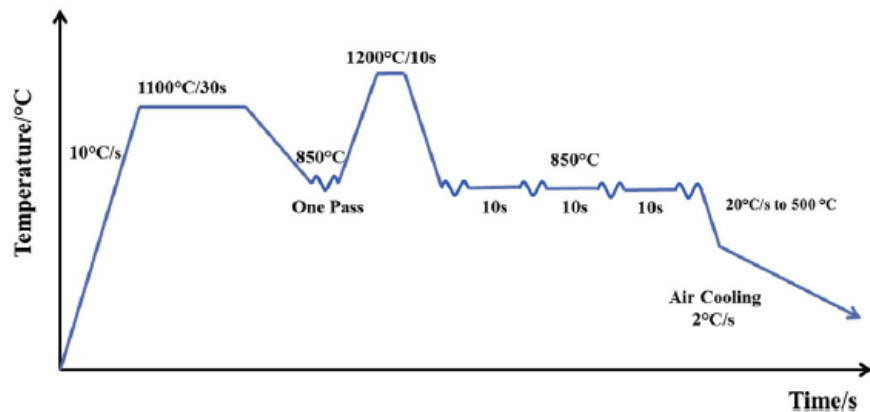
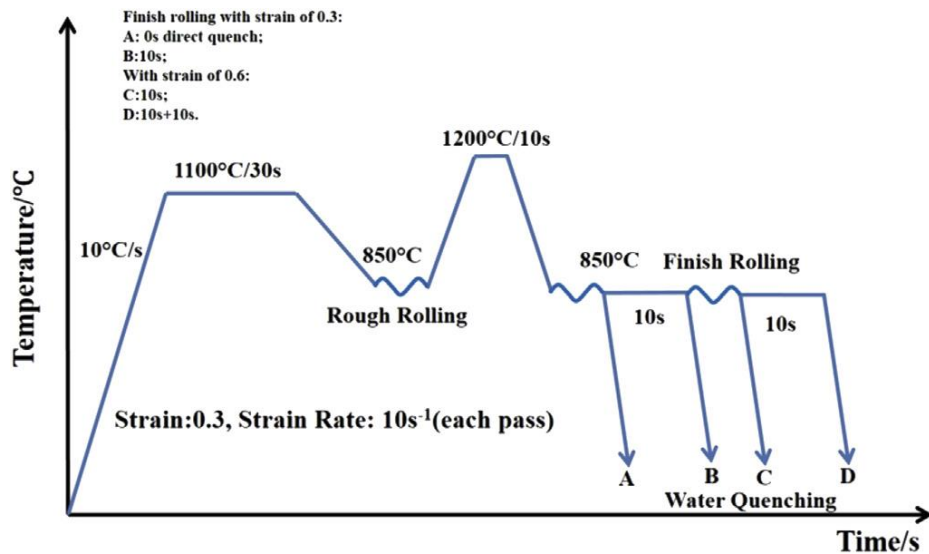
• Impact

- Optimised thermomechanical process route
- Optimised cooling/heat treatment conditions
- Greater homogeneity leading to hitting tighter specifications
- Thereby enhanced mechanical properties

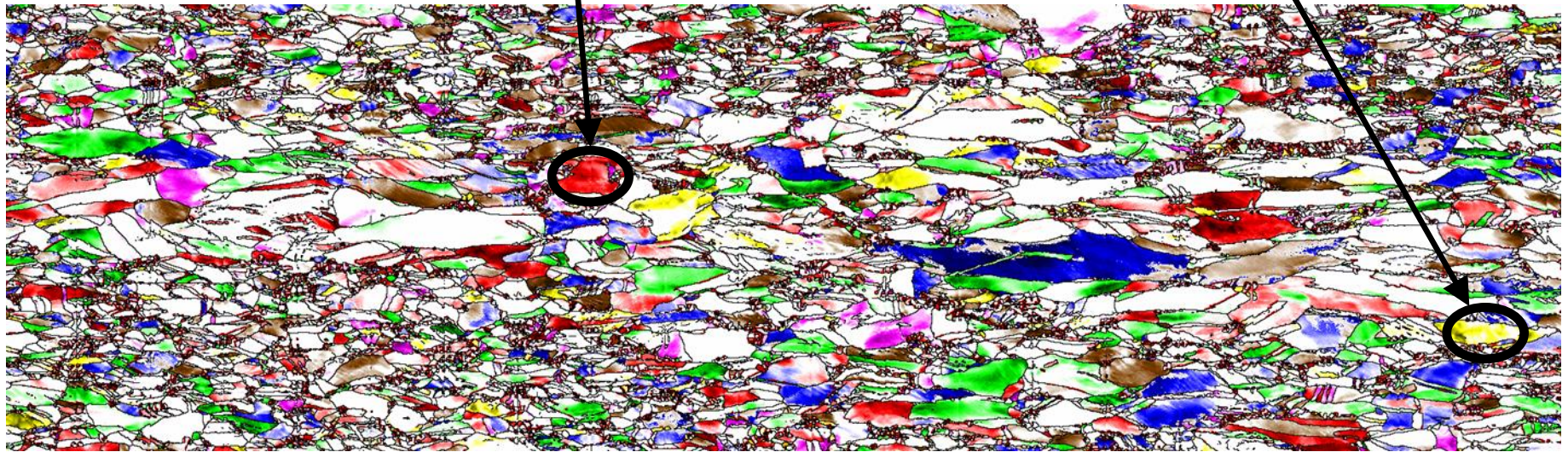
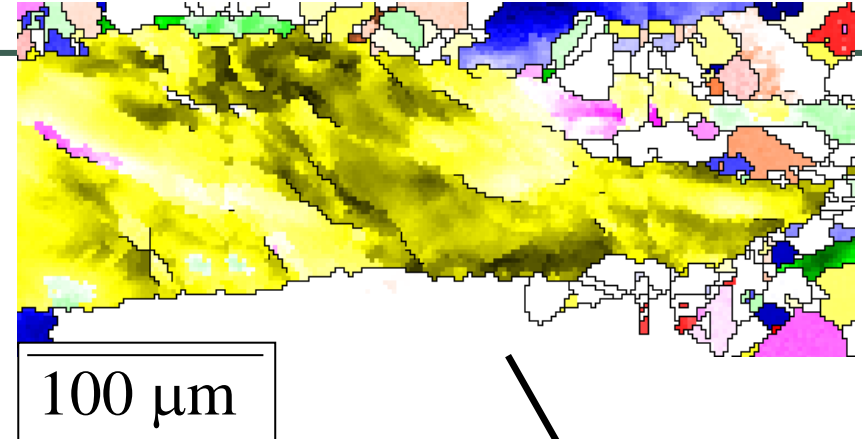
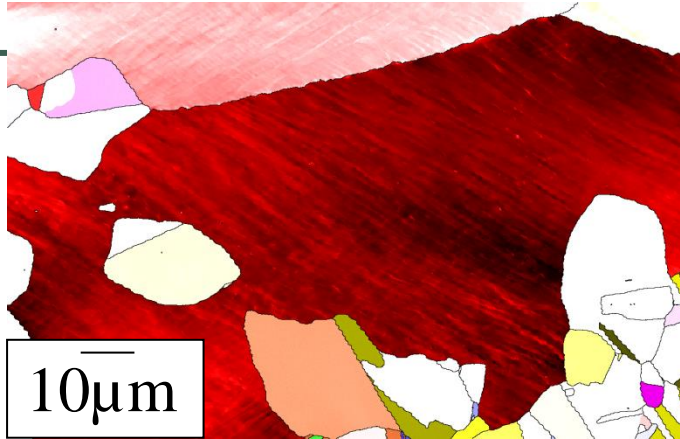
Simulation of the whole thermomechanical process cycle: world leading hot deformation simulators









Optimising thermomechanical processing to minimise grain size

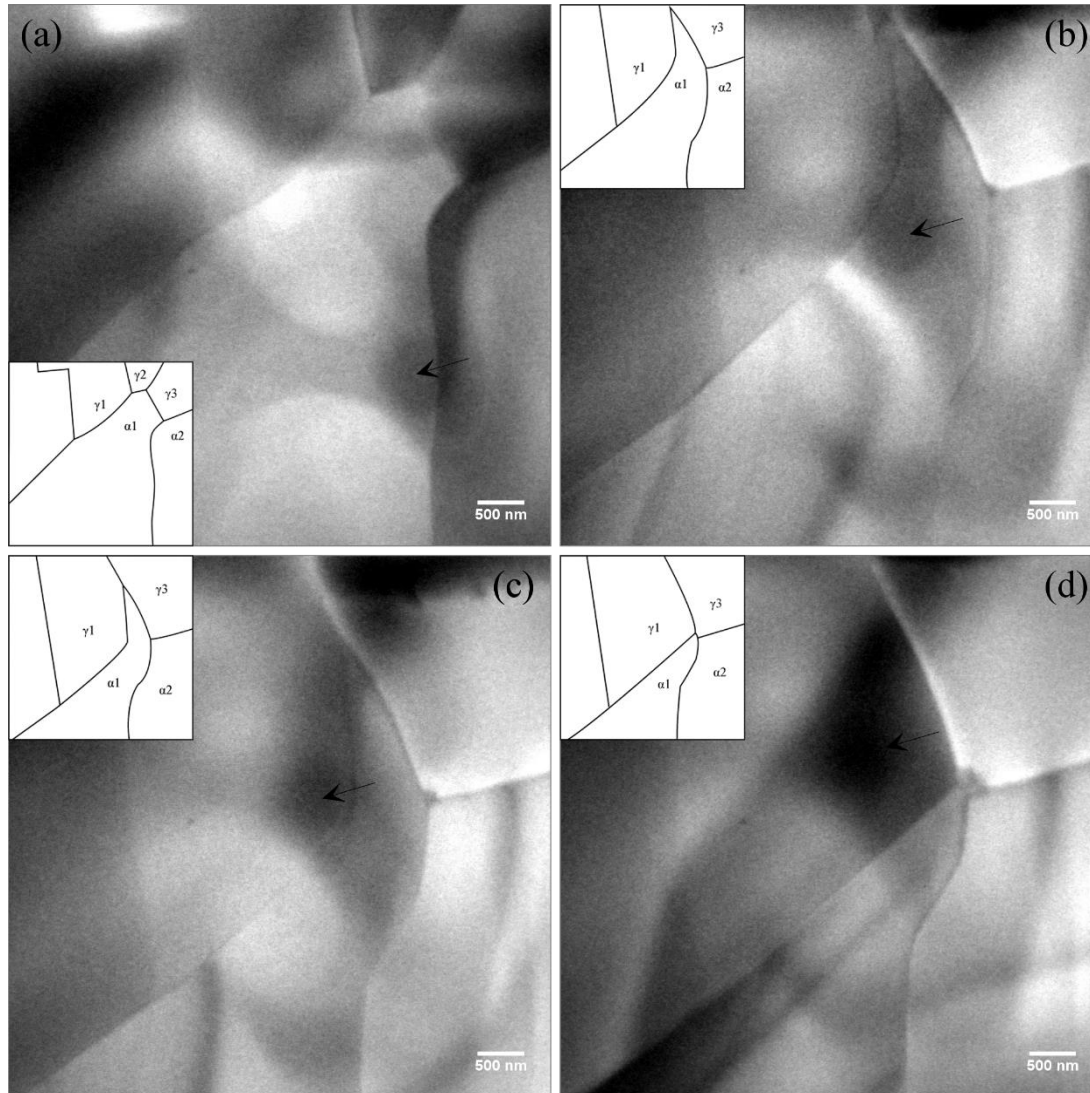


Product uniformity: Quantification of complex microstructure

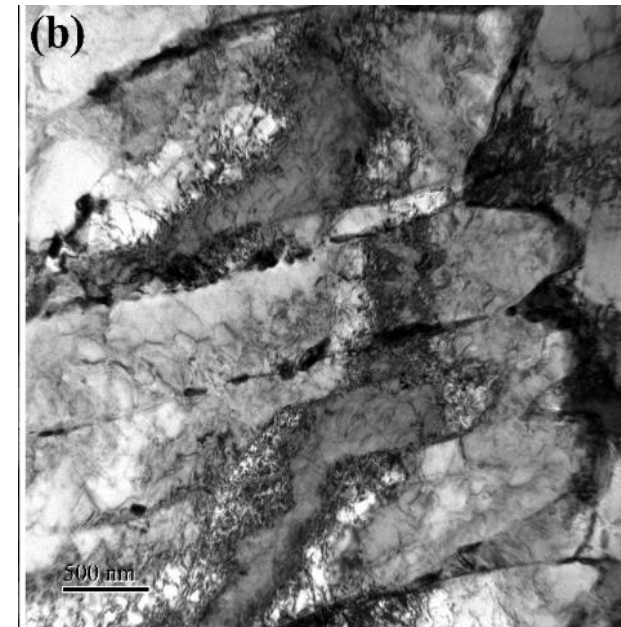
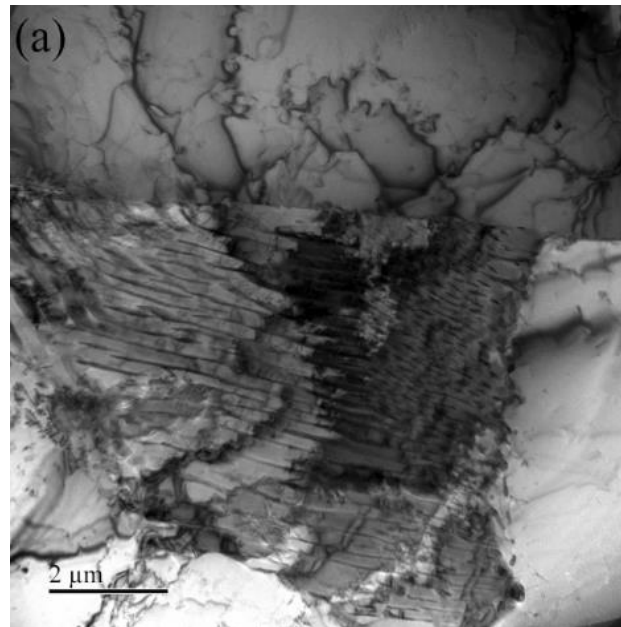


- | | | |
|---|--|---|
|  Goss |  S |  ss |
|  Cube |  Copper |  ated Goss |

Complexity of transformation from austenite

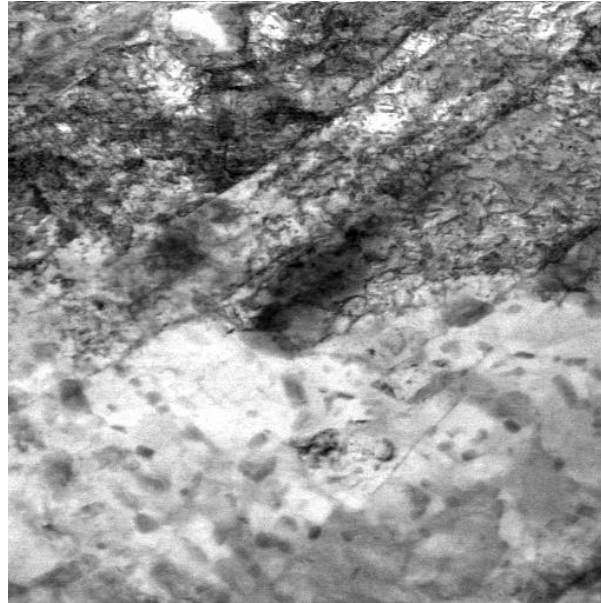


Output

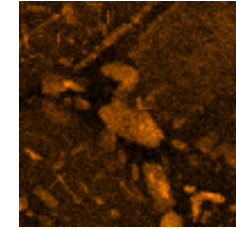


Direct observations of transformation of austenite to pearlite and ferrite

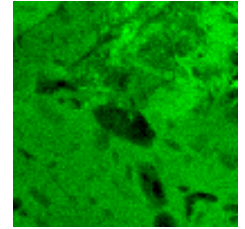
The crucial role of segregation



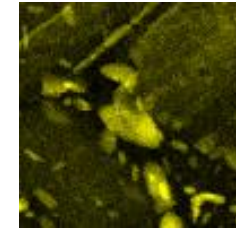
Cr



Fe-L



Mn



Complex martensitic structures



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Swansea University
Prifysgol Abertawe



SUSTAIN

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