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Augmenting the thermodynamic oxidation data of dual phase steels using synthetic data

Nicola Beech

SPEAKER / LEAD AUTHOR:
Nicola Beech

INSTITUTION:
University of Warwick

OTHER AUTHORS:
Dr James Edy, Tata Steel Europe
Dr Didier Farrugia, Tata Steel Europe
Professor Michael Auinger, University of Warwick

ABSTRACT:
Dual Phase (DP) steels have excellent mechanical properties but lack corrosion resistance. Consequently, they require galvanising, which directly follows annealing in a modern plant. Under annealing conditions (around 800^{o}C and up to 100% hydrogen), the alloying elements, typically 1.5-2wt% Mn and 0.5-1.0wt% Si, are prone to selectively oxidise. If non-wettable surface oxides form, such as MnO and SiO2, liquid zinc may not adhere, resulting in coating defects. Internal oxide formation is therefore preferred to keep the steel surface clean. While oxidation studies can inform the manufacturing route of these complex steels, the thermodynamic databases they often utilise may be incomplete. To resolve this issue, the databases could be augmented using synthetic data, data generated to replicate the statistical properties of real data. This work explores the advanced machine learning techniques of synthetic thermodynamic data generation to augment oxidation data for greater insight into DP steel oxidation near critical limits.