

An overview of new opportunities provided by hybrid modelling coupling multi-physical and data models

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Metallurgical models

Hybrid models

Process/product control

Hybrid modelling coupling classical multi-physical models with data models provides new opportunities in many fields: improvement of model accuracy with ignorance models, acceleration of lead time and knowledge development by interpretation of data models, reduction of calculation time offering new on-line control opportunities including the development of new applications not achievable with classical physical models. Different developments and steelmaking applications based on mean-field metallurgical models will be presented to illustrate the potential of hybrid modeling using different kinds of mathematical algorithms. Solutions based on metallurgical modelling developed by ArcelorMittal global R&D cover today many domains such as on-line control of microstructure and mechanical properties for hot strip mill and annealing line, prediction of metallurgical inheritance along the processing route between the hot band and annealing for flat products, the prediction of many final in-uses properties...Focus will be done on the availability and quality of data coming from different sources (lab data, sensors of new generation, computing architecture, modelling...) and the large range of strategies available to develop efficient solutions combining different kinds of data and mathematical algorithms. These new solutions contribute significantly to the development of industry 4.0 and differentiation of European steelmaking industry. Finally, applications to new challenge of decarbonization of steel industry will be presented with some illustration on expected variability of scrap quality and associated residual elements which can significantly impact the scattering of final in-uses properties, but also the steel processability.