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How the magnetohydrodynamics contributes to modern metallurgical production: examples from our experience

Friday, February 4, 2022 10:00 AM (40 minutes)

The science of magnetohydrodynamics (MHD) is an invaluable tool in modern industrial development due to the growing usage of electrical energy and environmental concerns. This talk will discuss a few examples from the metallurgical industry. The annual production of primary aluminium is about 64 million tons, nearly all via an electrochemical process consuming 848 TWh of electricity (or 3% of the worldwide total), and it caused 1% of human greenhouse gas emissions. It is estimated that optimization by applying MHD knowledge permits to decrease energy use by at least 34 TWh and to reduce the greenhouse gas emissions by 13M tons each year. The traditional steel production is gradually moving to the electrical arc furnaces, already producing about 25% of steel worldwide, while the MHD mixing and power optimization are largely poorly understood. High-quality metal alloys for aerospace and energy industry applications are produced by the vacuum arc or slag melting techniques where MHD plays a crucial role. Modelling these and multiple other processes requires detailed knowledge of thermophysical material properties of specific alloys at extreme temperatures – a task where contactless electromagnetic levitation plays a crucial role. New applications emerge continuously to drive the growing interest in MHD research.

Primary author: BOJAREVICS, Valdis (University of Greenwich)

Presenter: BOJAREVICS, Valdis (University of Greenwich)

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