Special Issue

Electromagnetic Stirring Technique in Metallurgy and Material Processing

Message from the Guest Editor

We develop a method and devices for the non-contacting electromagnetic stirring of electrically conductive substances (e.g., liquid metals, electrolytes) using oscillating inhomogeneous magnetic fields. Oscillation of the magnetic field produces a controllable Lorentz force that creates a velocity field in the electrically conductive substance, promoting mixing of locally heated fluid or added substances (e.g., particulate additives). It improves homogenization of additives during the production of metallic alloys, e.g., in the steel continuous casting process, in aluminium production, etc. Molten metal flow at high temperature can be effectively measured by using external constant magnetic fields. The applied technique is termed Lorentz force flowmeter (LFF) and is based on exposing the flow to a magnet system and measuring the drag force acting upon it. We derive the scaling law that relates the force acting on a localized magnet system to the flow rate of the electrically conducting fluid. This law shows that LFF, if properly designed, has a wide range of potential applications in ferrous and non-ferrous metallurgy.

Guest Editor

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Metallic materials play a vital role in the economic life of modern societies; contributions are sought on fresh developments that enhance our understanding of the fundamental aspects related to the relationships between processing, properties and microstructure – disciplines in the metallurgical field ranging from processing, mechanical behavior, phase transitions and microstructural evolution, nanostructures, as well as unique metallic properties – inspire general and scholarly interest among the scientific community.

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