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Modelling Contactless Ultrasound Treatment in a DC Casting Launder

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Abstract

Ultrasonic processing can be performed without a vibrating probe by electromagnetic induction with a suitable frequency where resonance conditions can be established. This contactless method is suitable for high-temperature or reactive metal alloys providing purity of the melt and durability of the equipment. Hydrogen bubbles coming out of solution grow by rectified diffusion, and larger bubbles escape from the top surface leading to degassing. Violent collapses of the remaining smaller bubbles help grain refinement. In this study, the application of a contactless ‘top-coil’ device to continuous casting via a launder is considered. Resonance is achieved by the positioning of baffles on either side of the coil. Electromagnetic forces also cause strong stirring, increasing residence time. The process is modelled using time domain and frequency domain methods, and results for the proposed setup are compared with data obtained for the immersed sonotrode. Accuracy and sensitivity to process and model parameters are discussed.

Keywords

- **Ultrasonic melt processing**
- **Numerical modelling**
- **Acoustic cavitation**
- **Acoustic resonance**

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