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Numerical investigation on role of vertical electromagnetic brake system in reducing remelting effect and improving thermal characteristics in thin slab continuous casting

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### Abstract

The direct impact of high temperature liquid metal on narrow face of the continuous casting mould results in remelting in the jet impact region on narrow face which causes an adverse effect on solidified shell growth. In this work, a numerical study has been conducted to analyse the turbulent flow behaviour of the molten steel, temperature distribution inside the mould region, and the growth of solidified shell within the mould when V-EMBr (Vertical-Electromagnetic Brake) system is applied. The V-EMBr system significantly changed the extent of double-roll flow of liquid metal inside the mould by imposing a strong electromagnetic force to the liquid metal throughout the EMBr region especially at high magnetic fields. Meniscus velocities have been lowered with V-EMBr close to the magnetic pole region, which inhibits foreign inclusions within the molten pool near the narrow face regions. The alterations in fluid flow patterns inside the mould changed the thermal and hence solidification behaviour in the mould region, leading to favorable conditions for increasing productivity and controlling cast quality. The reduction in non-uniform shell growth and improvement in shell thickness obtained with the application of V-EMBr may help in reducing surface defects, and providing stronger shell at the mould exit.

### Keywords

Continuous casting; Fluid flow; Heat transfer; Solidification; Magneto hydrodynamics; Electromagnetic brake

