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THE DEVELOPMENT OF SIMULATORS FOR THE ESR AND VAR REMELT PROCESSES

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ABSTRACT

Mathematical modelling studies of the remelt processes afford valuable insights into the solidification processes, but they generally present an instantaneous snapshot of conditions in the liquid pool rather than a global view of the entire process. This paper describes the development of simulators for the ESR (round and slab) and VAR remelt processes in different production configurations. Each predicts the behaviour of the remelt process from start to finish of melting, including calculation of solidification conditions, heat balances, and voltage/current/electromagnetic field distributions within the furnace and the ingot.

Key to the development of these simulators is the formulation of a model for the energy source in each process. This source model enables the top ingot boundary condition to be calculated from the furnace operating parameters (voltage, current or melt rate, arc gap or swing depth), process parameters (electrode/crucible dimensions) and furnace characteristics (furnace resistance, current flows). Additional data describing the physical characteristics of the furnace and the boundary conditions for the process are incorporated into the models. The details of each simulator for the ESR and VAR processes are described.

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