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The simulation of grain selection in spiral grain selector of a Ni-based single crystal superalloy

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ABSTRACT

The grain selection during single crystal casting of Ni-based superalloy DD403 in spiral grain selector was simulated by a coupled ProCAST and CAFE model. The predicted solidification grain structure and the texture evolution were validated by comparison with the microstructural observation and the electron back scattered diffraction (EBSD) results. It was shown that the grain structures and crystallographic texture evolution in the spiral grain selector can be predicted well by the model. The grain orientations are found to be optimized only in starter block and no optimization occurs during grain selection in the spiral selector, which is just used to rapidly but randomly select one single grain. It obviously depends on the location of the grains in the spiral passage and has no apparent connection to the orientation of the grains, whether the grains are selected or blocked during the solidification in spiral grain selector.

KEYWORDS: directional solidification, single crystal superalloys, crystal orientation