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SIMULATION AND EXPERIMENTAL VALIDATION OF ANODIC COPPER SOLIDIFICATION

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Abstract. In this work we present an experimental and numerical analysis of anodic copper solidification. The aim of this study is to perform an experimental validation of numerical results computed using a thermal formulation including microstructural evolution written in a finite element framework. A set of experiments is carried out testing primary and eutectic phase formation in copper. The effect of heat extraction conditions is evaluated using sand, graphite, and steel molds to promote different cooling rates. The proposed microstructural model takes into account nucleation and grain growth laws based on thermal undercooling together with microstructural evolution. The primary copper evolution model is based on solute diffusion at the grain scale and on the dendrite top-growing kinetic; meanwhile, the eutectic evolution is assumed proportional to the copper initial composition and eutectic undercooling. The computed final values for the grain density and radius, including primary or dendritic phase and eutectic solid volumetric fractions, are validated with the experimental measurements. The support provided by CONICYT and FONDECYT Project No. 1095028 is gratefully acknowledged.