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SIMULATION AND EXPERIMENTAL VALIDATION OF MICROPOROSITY FORMATION IN ANODIC COPPER SOLIDIFICATION

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Abstract. In this work we present an experimental and numerical analysis of microporosity formation during anodic copper solidification. The aim of this study is to perform an experimental validation of numerical results computed using a thermally coupled flow formulation including microstructural evolution and microporosity formation written in a finite element framework. A set of experiments is carried out testing primary and eutectic phase and microporosity formation in copper. The effect of heat extraction conditions is evaluated using sand, graphite, and steel molds to promote different cooling rates. The microstructural model takes into account nucleation and grain growth laws based on thermal undercooling together with microstructural evolution. The proposed microporosity model accounts for the partial pressures of gases together with a simple formulation of solute distribution in liquid and solid phases. The computed final values for pore volumetric fraction are validated with the experimental measurements. The support provided by CONICYT and FONDECYT Project No. 1095028 is gratefully acknowledged.