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Effects of supersaturation on pore shape in solid

P. S. Wei[1], S. Y. Hsiao[2]

Department of Mechanical and Electro-Mechanical Engineering, National Sun Yat-Sen University Kaohsiung 80424. Taiwan, ROC

pswei@mail.nsysu.edu.tw

macplayer.tw@yahoo.com.tw

Abstract

The shape of a pore resulting from a bubble entrapped by a solidification front with different supersaturation ratios is predicted in this work. Supersaturation ratio, representing the ratio between solute concentration and saturation solute concentration, determines nucleation of a bubble and development of the pore shape in the early stage. Pore formation and its shape in solid influence contemporary issues of biology, engineering, foods, geophysics and climate change, etc. This work extends and combines previous models accounting for realistic mass and momentum transport, and physico-chemical equilibrium of solute gas across the bubble cap to self-consistently determine shape of the bubble cap beyond the solidification front and the pore shape in solid. The study also deal with that pore formation can be resulted from three different mechanisms, depending on the directions and magnitude of solute gas transport across the bubble cap. Case 1 is subject to solute transport from the pore across the cap into the surrounding liquid in the early stage. Cases 2a and 2b indicate opposite direction of solute transport. In contrast to Case 2b, the effect of solute transport on solute gas pressure in the pore in Case 2a is stronger than

[1] Tel: 886-987035071

[2] Tel: 886-956335028