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The effects of initial conditions on fabrication of porous material

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Pore formation and its shape in solid influence not only microstructure of materials, but also contemporary issues of various biology and medical sciences, etc. How to produce lotus-type porous material chosen as a scaffold is a challenging topic in tissue engineering. A pore in solid is usually resulting from entrapment of a nucleated bubble due to super-saturation by a solidification front. This work account for mass and momentum transport across a coupled shape of the bubble cap in physico-chemical interfacial equilibrium beyond the solidification front. Accurate determination of contact angle from a realistic shape of the cap is essentially required to predict the relevant shape of the pore in solid. It is systematically found that there are two different solute transport models subject to thin and thick thicknesses of concentration boundary layers on the solidification front. Case 1 accounts for species transport from the pore across an emerged cap through a thin concentration boundary layer on the solidification front into surrounding liquid in the early stage, whereas, case 2 is subject to species transport from the surrounding liquid across a submerged cap within a thick concentration boundary layer into the pore. The analytical results show the effects of initial conditions such as bond number and initial solute concentration in the liquid on development of the pore shape in solid. The predicted pore shape agrees with experimental data. How to select initial conditions to control porosity in solid has therefore been revealed.

Biography

Peng-Sheng Wei completed his PhD in Mechanical Engineering department at University of California, Davis, in 1984. He has been a Professor in Department of Mechanical and Electro-Mechanical Engineering of National Sun Yat-Sen University, Kaohsiung, Taiwan, since 1989. He has contributed to advancing the understanding of and to the applications of electron and laser beam, plasma, and resistance welding through theoretical analyses coupled with verification experiments. He has published more than 80 journal papers and given keynote or invited speeches in international conferences more than 70 times. He was a Fellow of American Welding Society (AWS) in 2007 and a Fellow of American Society of Mechanical Engineers (ASME) in 2000. He has been the Xi-Wan Chair Professor at National Sun Yat-sen University (NSYSU) since 2009.

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