A criterion for bubble merging in liquid metal: computational and experimental study

Mojtaba Barzegari[a,*], Hossein Bayani[b], Seyyed Mohammad Hossein Mirbagheri[b]

[a] Department of Biomedical Engineering, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran

[b] Department of Mining and Metallurgical Engineering, Amirkabir University of Technology, Tehran, Iran

[*] Corresponding author: P.O.B. 1439957131 Tehran, Iran, mbarzegary@alumni.ut.ac.ir

1. Abstract

An innovative model is presented for merging of bubbles inside a liquid metal. The proposed model is based on forming a thin film (narrow channel) between merging bubbles during growth. Rupturing of the film occurs when an oscillation in velocity and pressure arises inside the channel followed by merging of the bubbles. The proposed model –based on lattice Boltzmann Method - is capable of simulating merging bubbles in micro, meso, and macro-scales with no limitation on the number of bubbles. Experimental studies reveal a good consistency between modeling results and real conditions.

Keywords: Foam Formation Modeling, Multiphase Fluid Dynamics, Lattice Boltzmann Method, Shan-Chen model, Aluminum Foam

2. Introduction

Metal foams as a complex of solid bubbles are known for their unique physical and mechanical properties. It is generally accepted that formability of metal foams is intimately correlated with the presence of particles. The physical understanding of foam formation in the presence of colloidal particles with no surface active material is very complex and still rather poor [1]. A variety of studies has been done to analyze the bubble stabilization parameters, most of which are focused on ionic liquids, especially in water. In addition, due to the presence of metallic bond in metal melt, no ionic or polar attraction/repulsion force is present, causing a