8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)

14–17 October 2016

Seattle, Washington | Hosted by Purdue University

SESSION 2: SOLIDIFICATION AND CASTING, SALON B

Co-Chairs: Qingyou Han, Purdue University; Lin Liu, Northwestern Polytechnical University; Dongke Sun, Shanghai Jiao Tong University; Shuanglin Chen, CompuTherm

SATURDAY, OCTOBER 15, 2016

Lattice Boltzmann modeling of dendritic growth and microstructure evolution in solidification of alloys

Dongke Sun, Shanghai Jiao Tong University; Purdue University; Qingyou Han, Purdue University; Mingfang Zhu, Southeast University

ABSTRACT

The article gives an overview of the lattice Boltzmann (LB) method as a powerful technique for the modeling of dendritic growth and microstructure evolution in solidification of alloys. Different from conventional modeling techniques, the kinetic theory-based background provides the LB models several distinctive advantages in modeling innovation, simulation fidelity, and computational efficiency. Intrinsic features of the LB models allow themselves to model microstructure evolution with other techniques defining growth kinetics of dendrites. A large amount of coupled models have been therefore developed in the past several decades, all of the studies have revealed that the LB method is indeed very promising as an efficient computational tool for the modeling of transport phenomena coupled with phase transformation during solidification. The LB method is an ideal approach for mesoscale and scale-bridging simulations. It is capable to tackling particularly dendritic growth and microstructure evolution with ubiquitous characteristics. Simulations using the LB methods offer insights into the underlying physics of microstructure formation during alloy solidification.

KEYWORDS: solidification, microstructure, dendritic growth, lattice Boltzmann method, alloys