

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

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Crystal growth patterns in undercooled Co₆₇Sn₃₃ hypereutectic alloy containing minor Nb

J. L. Kang; J. F. Li, Shanghai Jiao Tong University

ABSTRACT

The growth of non-planar interfaces during solidification can be classified into two major modes: dendritic and seaweed. During dendritic growth, the new branches form at a distance behind the tips of the existing branches. In contrast, seaweed growth occurs when the new branches form by branching at the tip of the existing branches, with their subsequent growth directions varying constantly. Currently, our knowledge of seaweed crystal growth in metals is very limited. In the present work, the growth behavior of primary β -Co₃Sn₂ phase in (Co₆₇Sn₃₃)_{100-x}Nb_x ($x = 0, 0.5, 0.8, \text{ and } 1.0$) hypereutectic alloys at different melt undercooling was investigated. The growth pattern of β -Co₃Sn₂ phase at low undercooling changes in the Nb content from fractal seaweed ($x = 0, 0.5$) into dendrite ($x = 0.8$) and then returns to fractal seaweed ($x = 1.0$). As undercooling increases, the dendritic growth of β -Co₃Sn₂ phase in (Co₆₇Sn₃₃)_{99.2}Nb_{0.8} alloy gives way to fractal seaweed growth at an undercooling of 32 K, and compact seaweed growth above a larger critical undercooling, as occurs in the other three alloys investigated, accompanied with a sharp rise in growth velocity. The growth velocity of β -Co₃Sn₂ slightly increases at low and intermediate undercooling but decreases at larger undercooling due to Nb addition.

KEYWORDS: crystal growth pattern, undercooling, third element, interfacial energy anisotropy