MS42-O4 *In situ* visualisation of dendritic growth in solidifying Ga – In alloys

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X-ray absorption contrast techniques are an effective tool for investigating solidification processes in opaque metallic alloys. This work is devoted to the *in situ* visualization of the dendritic growth during the bottom-up solidification of a Ga-25wt%In alloy under natural and forced convections. Many effects of melt flow on the mushy zone structure were observed by standard X-ray radiography with a spatial resolution of 5-10 microns [1, 2]. The flow-induced variations of the local solute concentration result in an unsteady development of the primary dendrites and trigger or inhibit the development of secondary and tertiary arms (Fig. 1). Variations of the vertical and lateral temperature gradients induce modifications of the melt flow pattern, which lead to different segregation structures and dendrite morphology. A more detailed analysis of the particular processes (a detachment of side branches and growth of a dendrite tip) were carried out using synchrotron X-ray radiography with a spatial resolution of less than 1 μm. The synchrotron experiments were performed at the ROBL beam line (BM20, European Synchrotron Radiation Facility, Grenoble) at an energy of 28.5 keV. The combination of synchrotron X-ray radiography and synchrotron X-ray diffraction shows a big potential for orientation analysis of the growing grains and lattice parameter determination of the solid phase.

References:

[1] Shevchenko N., Boden S., Gerbeth G. and Eckert S., Metall. and Mat. Trans. A 44 (2013) 3797-3808

[2] Shevchenko N., Roshchupkina O., Sokolova O., Eckert S., Journal of Crystal Growth 417 (2015) 1-8

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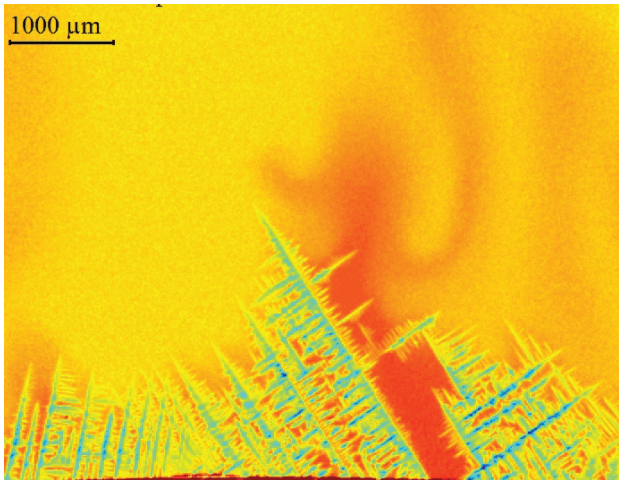

Figure 1. Snapshot of the dendritic structure and gallium plumes in the solidifying Ga – In alloy.

Keywords: Directional solidification, melt flows, X-ray radiography, Ga–In alloys