In-situ X-ray video microscopy of alloy solidification

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Directional solidification of thin alloy sheets has been studied in-situ by X-radiography using high brilliance synchrotron radiation. Use of a high-resolution, low-noise fast readout detector provided spatial resolutions down to 1.5 microns and temporal resolutions down to 0.15 s, permitting video microscopy of solidification phenomena such as columnar and equiaxed dendrite growth, eutectic and monotectic growth, primarily in aluminium alloys. The results have brought new insight into fields such as mechanisms of dendrite fragmentation, and for droplet formation, hydrodynamically driven coagulation and microstructure formation during monotectic solidification. Image processing can provide in-situ information on important solidification parameters such as crystal morphologies, interface velocities, compositional variations in the melt, and flow fields, and accordingly the method is expected to be of importance in both phenomenological and quantitative validation of microstructure growth models. The video sequences are also particularly useful in teaching solidification.

The presentations and videos review the technique and present examples of images obtained during solidification of aluminium alloys.

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TITLE	DESCRIPTION	
In-situ studies of dendrite fragmentation in Al-Cu	Presentation overview of technique and results of experimental investigations of dendrite fragmentation in Al-Cu alloys	[Click here to view]
Synchrotron Radiation	Presentation detailing experimental procedures	[Click here to view]
Constrained Growth	Presentation of results investigating constrained growth in an Al-Cu alloy	[Click here to view]
Equiaxed solidification	Video clip of equiaxed solidification in an Al-20Cu alloy	[Click here to view]
Microporosity	Video clip of microporosity in an Al-30Cu alloy	[Click here to view]
Solute Boundary Destabilization	Video clip of solute boundary destabilization in an Al-30Cu alloy	[Click here to view]
Fragmentation - Solute Pile-up	Video clip of solute pile-up in an Al-20Cu alloy	[Click here to view]
Fragmentation - Recalescence	Video clip of recalescence in an Al-30Cu alloy	[Click here to view]