MM 48: Topical Session Growth Kinetics IV

Time: Thursday 11:45–13:00 Location: H4

Topical Talk MM 48.1 Thu 11:45 H4

X-radiographic video microscopy studies of alloy solidification processes — •Ragnvald H Mathiesen[1] and Lars Arnberg[2] — [1]Department of Physics, NTNU, N-7491 Trondheim, Norway — [2]Department of Materials Technology, NTNU, N-7491 Trondheim, Norway

The combination of state-of-the art synchrotron X-ray sources and recent developments in X-ray hardware such as focusing optics and fast low-noise high-resolution cameras have opened for in situ studies of solidification processes at spatiotemporal resolutions approaching and even beyond those that can be achieved with optical video microscopy. An overview of recent case studies with Al-Cu and Al-Si based binary and tertiary systems will be given, with particular focus on how the experimental results compares qualitatively and quantitatively with results from modeling at the length and time scales of diffusive and convective mass transport. Finally, results from recent experiments will be presented showing how the boundaries of radiographic performance can be extended both spatially and temporally to address faster dynamics and approach capillarity limited kinetics.

MM 48.2 Thu 12:15 H4

Anomalous dendrite growth in undercooled melts of Al-Ni alloys — Roman Lengsdorf[1,2], •Dirk Holland-Moritz[1], and Dieter M. Herlach[1] — [1]Institut für Materialphysik im Weltraum, Deutsches Zentrum für Luft- und Raumfahrt (DLR), 51170 Köln, Germany — [2]Institut für Festkörperphysik, Ruhr-Universität Bochum, 44780 Bochum, Germany

We have measured dendrite growth velocities as a function of undercooling on liquid Al-Ni alloys using electromagnetic levitation on Earth and in reduced gravity. In total, six differently concentrated alloys are investigated, one of them for comparative investigations during the sounding rocket mission TEXUS 44. While on the Ni-rich side of Al-Ni alloys growth velocity is increasing with increasing undercooling, Al-rich Al-Ni alloys show an unusual decrease of the growth velocity with increasing undercooling in the terrestrial investigations. The comparison of the results of complementary terrestrial and microgravity experiments suggests that the anomalous growth behavior of Al-rich Al*Ni alloys may be caused by fluid-flow related processes during non-equilibrium solidification of undercooled melts. Support by ESA within contract number 15236/02/NL/SH (NEQUISOL) and by the European Commission EC under contract FP6-500635-2 (IMPRESS) is gratefully acknowledged.

MM 48.3 Thu 12:30 H4

Undercooling and solidification of Ni_2B under different convective flow conditions — •Sven Binder[1,2], Jianrong Gao[3], and Dieter M. Herlach[1] — [1]Institut für Materialphysik im Weltraum, Deutsches Zentrum für Luft- und Raumfahrt, 51170 Köln, Germany — [2]Institut für Festkörperphysik, Ruhr-Universität Bochum, 44780 Bochum, Germany — [3]Key Laboratory of Electromagnetic Processing of Materials, Northeastern University, Shenyang 110004, China

We investigate the kinetics of crystal growth by measurements of the dendrite growth velocity as a function of undercooling during non-equilibrium solidification. Measurements are conducted under different conditions of convection. The liquid samples are levitated and undercooled in strong alternating electromagnetic fields leading to forced convection. Inductive stirring is avoided by processing the samples in a glassy slag where only natural convection is present. Forced convection and natural convection can be reduced by performing undercooling experiments in reduced gravity. The experimental results obtained under different conditions are compared to each other in order to investigate the influence of convection on the growth dynamics of dendrites in undercooled melts. The congruently melting compound Ni_2B is chosen as a suitable sample system. It forms an intermetallic phase with growth velocities that are comparable to the fluid flow velocities in electromagnetically levitated melts. The results are analyzed within dendrite growth models and reveal that the growth velocity is essentially influenced by forced convection in strong electromagnetic fields. The present work is supported by DFG under contract HE1601/25.

MM 48.4 Thu 12:45 H4

In Situ Observation of Dislocation Dynamics at the TOPO-TOMO Beamline at the Synchrotron Light Source ANKA — •Andreas Danilewsky[1], Jochen Wittge[1], Arne Cröll[1], Adam Hess[1], David Allen[2], Patrik McNally[2], Patrick Vagovic[3], Zhijuan Li[3], Tilo Baumbach[3], Eider GorosteguiColinas[4], Jorge Garagorri[4], Reyes Elizalde[4], Matteo Fossati[5], Keith Bowen[5], and Brian Tanner[5] — [1]Kristallographie, Universität Freiburg — [2]RINCE, Dublin City University, Ireland — [3]ANKA, ISS, Research Center Karlsruhe — [4]CIT, Sab Sebastian, Spain — [5]Physics Dept., Durham, UK

White beam X-ray topography at the Topo-Tomo beamline of the synchrotron light source ANKA (Research Centre Karlsruhe) is used to monitor in situ the origin and the dynamics of dislocations in silicon at high temperatures. The (100) Si sample with well defined, artificial defects from a nanoindenter was heated in a mirror heater up to 1000°C. During the heating the transmission X-ray topographs were taken with a CCD-camera system continuously every second resulting in a movie of the formation and motion of dislocations. It will be shown, that the indents act as the source for dislocation loops. The dislocations move with about 3.4 x 10-5 m/sec inside two opposite inclined {111} glide planes. Finally slip bands of 60°-dislocations are formed. The experimental details of the high temperature topography, the analysis of dislocations as well as the first results of the dislocation dynamics and slip band formation will be presented.