Read-Me file for X-ray tomography dataset for 'Caught in the act: The mechanism of eutectic modification by trace impurities'

Saman Moniri, Xianghui Xiao, and Ashwin J. Shahani
Contact: moniri@umich.edu

Research Overview:
The solidification pathways and interfacial dynamics of an irregular eutectic in the presence of trace metallic modifier species was investigated *in situ* using X-ray microtomography (XRT) at the Advanced Photon Source in Argonne National Laboratory (Argonne, IL). The 4D (*i.e.*, space- and time-resolved) raw X-ray projections are provided in this dataset.

Methods:
The XRT experiments were conducted at Sector 2-BM at the Advanced Photon Source in Argonne National Laboratory (Argonne, IL, USA). The polychromatic 'pink' X-ray beam was focused on the samples and a 20 μm thick LuAg:Ce scintillator converted the transmitted X-rays to visible light. High-resolution imaging was accomplished utilizing a PCO Edge CMOS camera equipped with a 10x magnifying objective to provide isotropic pixel sizes of 0.65 mm x 0.65 mm. The tomographic field-of-view measured 2,560 x 600 pixels (i.e., 1,664 mm in width by 390 mm in height). The camera frame rate and exposure time were 50 Hz and 14 ms, respectively. Due to the small penetration depth through the 'heavy' element Ge (51.6 wt.%), relatively long exposure times were required to ensure high signal-to-noise images. Given the 1 mm diameter of each sample, the temperature distribution was assumed to be uniform within the sample. During acquisition, the sample was rotated continuously at a rate of 6° per second. During each 180° rotation of the sample, 1,500 projections were collected. The large number of projections recorded (in addition to the high exposure time of 14 ms) guaranteed high-quality images. This combination of acquisition parameters optimally allowed for a temporal discretization of 20 s between consecutive 3D reconstructions. Data were collected for roughly 450 s, resulting in 22,500 total projections and 15 total reconstructions. Reconstruction of the tomographic data was performed using TomoPy, a Python based open source framework. Subsequently, the grayscale reconstructions were segmented, i.e., transformed into a computable representation of their parts (liquid, eutectic Ge, and eutectic Al), implemented in the Image Processing Toolbox™ of MATLAB R2016a.

File Inventory:
Two .hdf files are provided, which can be opened in HDFView. One file contains the X-ray projections of the fully-liquid phase, and the other file includes the projections collected during solidification. The files can be distinguished by their respective names.

Use and Access:

Suggested Citation to the Data:
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