A framework for automatic segmentation in three dimensions of microstructural tomography data

Routine use of quantitative three dimensional analysis of material microstructure by in particular, focused ion beam (FIB) serial sectioning is generally restricted by the time consuming task of manually delineating structures within each image slice or the quality of manual and automatic segmentation schemes. We present here a framework for performing automatic segmentation of complex microstructures using a level set method. The technique is based on numerical approximations to partial differential equations to evolve a 3D surface to capture the phase boundaries. Vector fields derived from the experimentally acquired data are used as the driving forces. The framework performs the segmentation in 3D rather than on a slice by slice basis. It naturally supplies sub-voxel precision of segmented surfaces and allows constraints on the surface curvature to enforce a smooth surface in the segmentation. Two applications of the framework are illustrated using solid oxide cell materials as examples.

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