

MM 30: Invited Talk: Liebscher

Time: Wednesday 15:00–15:30

Location: SCH A 251

Invited Talk

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Direct observations of grain boundary phase transformations in metallic alloys — ●CHRISTIAN LIEBSCHER — Max-Planck-Institut für Eisenforschung, 40237 Düsseldorf, Germany

Grain boundaries (GBs) play a pivotal role in determining the properties of metallic materials. In most considerations, GBs are seen as a simple 2D defect. However, thermodynamic concepts already proposed 60 years ago showed that GBs can undergo phase transformations, but the search for them has been in vain due to their confined nanoscale nature.

We show that GB phases exist in elemental copper. Atomic resolu-

tion scanning transmission electron microscopy is used to unravel multiple coexisting GB structures in the same GB. The intrinsic character and thermodynamic properties of the GB phases and their transitions is investigated by atomistic simulations. We find that the GB phase junction, a line defect that separates different GB phases, is kinetically limiting the transformation and plays a decisive role in the nucleation and arrangement of GB phases within the interface. By heating GBs inside of the electron microscope, we are able to directly observe how GB phases evolve at elevated temperatures with atomic resolution. In the remainder of the talk, we will also discuss the impact of solute segregation on GB transitions in copper and titanium alloys by exploring the local atomic arrangement of solutes within the GB.