Capturing Atomic Rearrangements in Diffusive Phase Transformations

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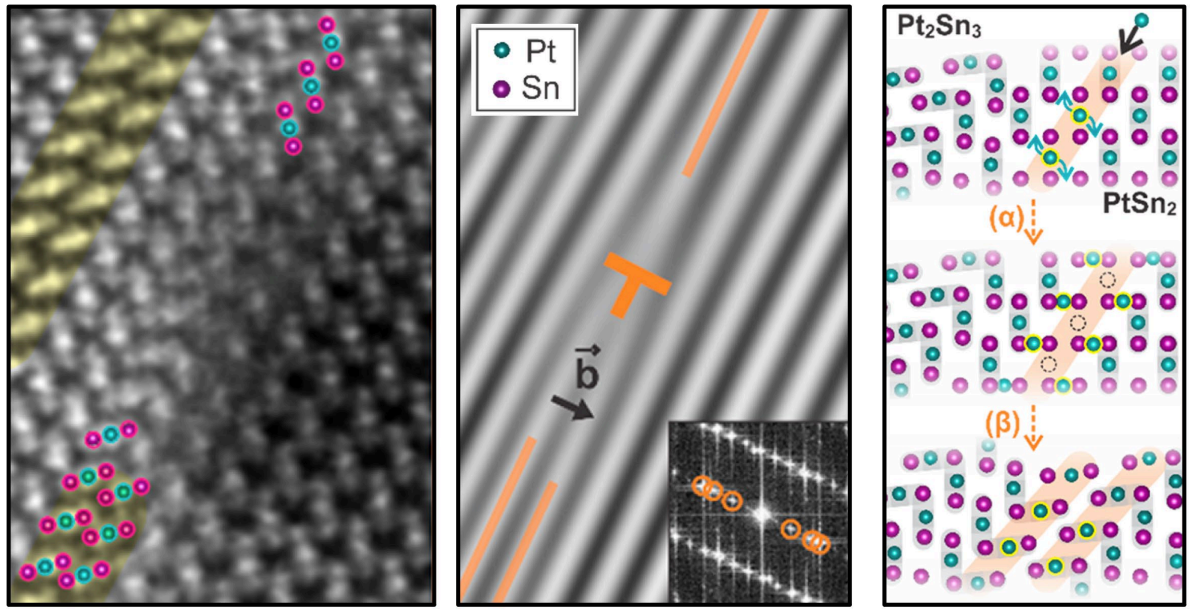
Analytical atomic-resolution scanning transmission electron microscopy (STEM) was adapted for *in-situ* measurements. It allowed capturing the atomic movements and rearrangements associated with diffusive solid-to-solid phase transformations in the Pt-Sn system. The results revealed that:

- **In $PtSn_4$ to $PtSn_2$ phase transformation, formation of a unique intermediate structure precedes common nucleation and growth.**

- **In $PtSn_2$ to Pt_2Sn_3 phase transformation the interfacial dislocations drive lattice distortions, diffusion and resulting phase transformation.**

These results show that diffusive solid-to-solid phase transformations are guided by the anisotropy (or by the lower symmetry) of the crystal structures of involved phases.



Atomic-resolution STEM image of moving edge dislocations at the $PtSn_2/Pt_2Sn_3$ interface during $PtSn_2$ to Pt_2Sn_3 phase transformation with a schematics describing the role of the dislocation in this solid-to-solid phase transformation.

Yun et al., Nano Lett. 23, 7576 (2023)

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- Such direct atomic-resolution *in-situ* STEM visualization of dislocation movements and atomic rearrangements during diffusive solid-to-solid phase transformations can be employed for other materials and line defects. It will help understanding the principles behind interactions (dynamics as well as kinetics) between various line and planar defects and guide their efficient engineering.

- Within the framework of this project, we organized high school students visit to university of Minnesota (UMN) to have interactive tours of the Electron Microscopy Center (EMC) at the Characterization Facility (CharFac) and see high-resolution TEM and SEM in action. The fist group that visited EMC was from Mounds View High School in Minnesota. They visited UMN during summer of 2023.

A group of students from Mounds View High School in Minnesota having a first-hand microscopy experience during their guided tour of EMC at UMN CharFac. The PI is explaining the inner workings of transmission electron microscope.