MM 5: Invited Talk: X. Fang (joint session MM/KFM)

Time: Monday 15:00–15:30 Location: H10

Invited Talk MM 5.1 Mon 15:00 H10

Room-temperature dislocations in oxide ceramics: from understanding to active engineering — •Xufei Fang — Institute for Applied Materials, Karlsruhe Institute of Technology, Karlsruhe, Germany

In the conventional picture, dislocations are most relevant for metals while ceramics are considered brittle and exhibit little or no plasticity at room temperature. However, recent years' research on dislocations in ceramics suggests that dislocations may have been much under-appreciated in ceramics. Proofs-of-concept for dislocation-tuned functional properties suggest that dislocations may hold great technological potential in advanced ceramics. As the prerequisite to harvest dislocation-tuned properties, engineering dislocations into ceramics without brittle fracture has thus become a pressing bottleneck. To tackle this challenge, we have separately examined the dislocation behavior including dislocation nucleation, multiplication and motion, enabling us to tune dislocations into ceramic oxides at room temperature. We can now achieve a dislocation density up to ~10^15/m^2 with a plastic zone size of up to milli-/centimetres using a mechanical deformation toolbox. We further extend the material toolbox by discovering and reporting more oxide perovskites that can be plastically deformed at room temperature across the length scale. The combined deformation and material toolboxes offer a new platform for studying the dislocation-tuned functional properties (e.g., electrical and thermal conductivity) and the mechanical properties (such as plasticity, toughness, and damage tolerance) over a wide range of length scales.