

Atomistic Dynamics of Deformation, Fracture and GB Migration in Oxides

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In order to clarify the deformation and fracture mechanism in oxides such as Al₂O₃ and STO, TEM in situ nanoindentation experiments were conducted for their single crystals and bicrystals. We successfully observed the dynamic behavior of twin formation, twin-GB interaction, pile-up dislocation, jog and kink formation and jog drag dynamics and so on. The mechanism of each dynamic behavior will be discussed in detail in this presentation. GB migration plays an important role in considering the high temperature mechanical properties. Recently, we have found that GB migration behavior in Al₂O₃ can be precisely controlled by the aid of the high-energy electron beam irradiation. This technique was applied to directly visualize the atomistic GB migration. It was revealed that the GB migration is processed by a cooperative shuffling of atoms in GB ledges along specific routes.

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