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Grain boundary sliding, fracture and dislocation motion in ceramics
Chair: Erik Bitzek(Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany)
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Yuichi Ikuhara

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Grain boundary sliding, fracture and dislocation motion in ceramics
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Ceramics have been widely used for structural applications because of their superior mechanical properties at high temperatures. It has been known that the behavior of GB sliding is strongly dependent on the GB characters such as misorientation angle between two adjacent crystals and GB plane, however, such effect has not been clarified yet. In addition, this effect in much influenced by dopant segregation at GBs. In this study, in order to clarify the atomistic mechanisms of GB sliding and its dopant effect, bicrystal studies have been performed to find the relationship between the atomic structures, chemistry and GB sliding behavior of Al2O3 ceramics. Several kinds of bicrystals including GBs with specific geometrical configuration were fabricated, and some of them were doped by rare-earth elements to enhance the GB segregation.
It has been reported that several oxides can be plastically deformed even at R.T. by dislocation slip like metals. So far, many experimental investigations have been tried for understanding the dislocation-grain boundary interaction, but these experiments were mostly carried out statically, and the fundamental processes are still not well understood yet. In this study, the nanoindentation experiments were conducted for SrTiO3 crystals their bicrystals inside TEM. Several kinds of TEM specimens for in situ nanoindentation experiments were prepared, that are single crystals and bicrystals including various types of GBs. The SrTiO3 single crystals were indented with the sharp diamond tip and successfully observed the dislocation dynamics. In the case of the GBs, the interaction between the introduced lattice dislocations and the GBs were directly observed. The dislocation-GB interaction and its dependence on the GB characters will be discussed in detail.