Plastic Deformation of $BiFeO_3$ Under a Cube-Corner Indentation Probe

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Dislocations are becoming vastly popular in the field of oxide perovskites, including the subgroup of ferroelectric martials, as functional defects used to tailor their macroscopic responses, i.e. their mechanical and ferroelectric properties [1, 2]. The brittle nature of perovskites at room temperature presents an obstacle in engineering dislocation post-synthesis via controlled mechanical deformation. Understanding the mechanisms leading to remnant deformation of these materials at macroscopic and local scales and their competition is therefore of central importance.

In this work, we focus on the local deformation mechanisms of $BiFeO_3$ deformed using a cube-corner indentation probe with a force between 200 μN and 2 mN. Analysis of the indentation curves, focusing on the first pop-in events, in combination with electron microscopy techniques revealed homogeneous dislocation nucleation, dislocation movement and propagation, grain subdivision in the immediate vicinity of the indented surface as well as cracking which was only observed above 1 mN. The influence of ferroelastic domain wall dynamics on deformation will also be discussed [3].

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