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Revealing the atomistic deformation mechanisms of face-centered cubic nanocrystalline metals with atomic-scale mechanical microscopy: A review

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Nanocrystalline metals have many functional and structural applications due to their excellent mechanical properties compared to their coarse-grained counterparts. The atomic-scale understanding of the deformation mechanisms of nanocrystalline metals is important for designing new materials, novel structures and applications. The review presents recent developments in the methods and techniques for in situ deformation mechanism investigations on face-centered-cubic nanocrystalline metals. In the first part, we will briefly introduce some important techniques that have been used for investigating the deformation behaviors of nanomaterials. Then, the size effects and the plasticity behaviors in nanocrystalline metals are discussed as a basis for comparison with the plasticity in bulk materials. In the last part, we show the atomic-scale and time-resolved dynamic deformation processes of nanocrystalline metals using our in-lab developed deformation device.

Keywords: *in situ* atomic-scale; nanocrystalline; deformation mechanisms; size effect