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Grain Growth in Nanocrystalline Metal Deformed in a Confining Environment. YUEJIAN WANG, Oakland University — Stress-induced grain growths were observed in many nanocrystalline metals and alloys. Correct understanding this unique feature is critical in designing and tailoring proper nanostructures for particular applications in mechanically harsh environments, e.g. high-stress concentration, mechanical vibrations. Though extensive researches have been carried out on metals or alloys subjected to deformation, experimental studies on metals deformed in a confining environment are severely lacking. Nearly all of the previous investigations on this theme were carried out either through theoretical simulations or by using TEM to probe grain variation in vacuo. In the present study, we employed a powerful high-pressure technique along with high energy synchrotron X-rays to monitor the grain size evolution in situ, in nanocrystalline Nickel deformed in varied confining environments. Our experimental data demonstrate, for the first time, that grain sizes grow with the increment of the confining pressure. Since plasticity strongly depends on the grain size of a given material, understanding and controlling fundamental mechanisms leading to stress-assisted grain growth may open a new route to improving the mechanical properties of nanocrystalline materials by tuning confining environment within which the deformation is operated.

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