

Revealing the role of microstructure architecture on strength and ductility of Ni microwires by in-situ synchrotron X-Ray diffraction

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Deformation mechanisms of cold drawn and electropolished nickel microwires are studied by performing in-situ tensile tests under synchrotron radiation. In-situ X-Ray diffraction allows understanding the mechanical response of the different grain families. The measurements were carried out on several microwires with diameters ranging from as-drawn 100 µm down to 40 µm thinned down by electropolishing. The as-drawn wires exhibit a core-shell microstructure with <111> fiber texture dominant in core and heterogeneous dual fiber texture <111> and <100> in shell. Reduction of specimen size by electropolishing results in a higher yield stress and along with reduced ductility. In-situ XRD analysis reveals that these differences are linked to the global variation in microstructure induced by shell removal with electropolishing, which in turn affects the load sharing abilities of grain families. This study thus proposes a new way to increase ductility and retain strength in nickel microwires by tuning the microstructure architecture [1].

Keywords: in-situ diffraction, microwires, size effects, architecture, plasticity.

References:

[1] Scientific Reports, Nature Publishing, 9 (2019), 79