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Micromechanics near the yield point of Nickel based superalloys

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Previous studies found non-monotonous lattice strain evolutions at small plastic deformations in the Nickel-based superalloys Inconel 718 and Haynes 282. For studying the micromechanical causes of this behaviour, the dependence of these effects on dislocation density, deformation history, and temperature history was examined. Due to the material‘s more readily observable non-monotonous lattice strain evolutions (when compared to Inconel 718), the material Haynes 282 was given special attention. In situ bulk diffraction experiments in the regime of small plastic strains yielded repeatable, non-monotonous strain evolutions, repeatable peak sharpening during unloading and no strong dependence on conditions typically expected to promote solute atom segregations to dislocation. The observed micromechanical softening is accompanied by strain localization (observable by slip band formation) and dynamic strain ageing at elevated temperatures.

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