

Effect of HPT processing on precipitation and mechanical behaviour of Maraging steel 250

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Tensile behaviour of maraging steel 250 is studied at room temperature in the as-received as well as in the High Pressure Torsion (HPT) processed condition before and after aging. The change in precipitate morphology, distribution and spacing has been characterised using Atom Probe Tomography (APT). Phase field modelling is employed to determine the effect of enhanced dislocation density during HPT processing on the precipitate morphology. Finite element modelling (FEM) is used to explain the changes in mechanical behavior, especially ductility as a result of this changed microstructure. Maraging steels which in their as-solutionised condition show extensive planar slip show a very different behaviour after HPT processing. The HPT processed steels also show accelerated aging kinetics. The different stages of hardening that are observed due to the deformation and aging conditions and their correlation to microstructural parameters-dislocation density, grain size and precipitate type and morphology are described. In particular, HPT processed steels show plate like Fe-Mo precipitates upon overaging that leads to a sharp decrease in ductility. This is attributed to the effect of enhanced diffusion pathways on the growth of precipitates in heavily dislocated materials. Strain partitioning around the differently shaped precipitates that act as stress concentrators for early onset of fracture are quantified through FEM and correlated to the overall mechanical behavior.

Keywords: Maraging steels; HPT processing; APT; Phase field modelling; Precipitate morphology

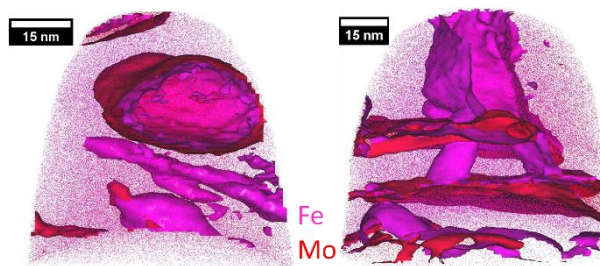


Fig.1 Precipitate morphology change due to HPT processing