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Effect of dislocation networks on precipitate morphologies: phase field modelling with atom probe tomography validation

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It is well known that dislocations can act as conduits for solute movement and hence lead to faster diffusion. In addition, if the dislocation network is planar, then, in such systems, the precipitate morphology can be influenced by the pipe diffusion. In this presentation, we describe a phase field model for precipitate growth in a system with dislocation networks. From the simulations carried out using the numerical implementation of the model, we show the effect of the dislocation network both on the growth kinetics and the morphology of the precipitate. We also show that these simulation results agree well with the atom probe tomography (APT) results on precipitation morphologies in a martensitic steel that is aged after high pressure torsion and that the morphology can have a strong say on mechanical behaviour.

Keywords: phase field modelling, precipitate growth kinetics, precipitate morphology, planar dislocation networks, pipe diffusion, APT, HPT

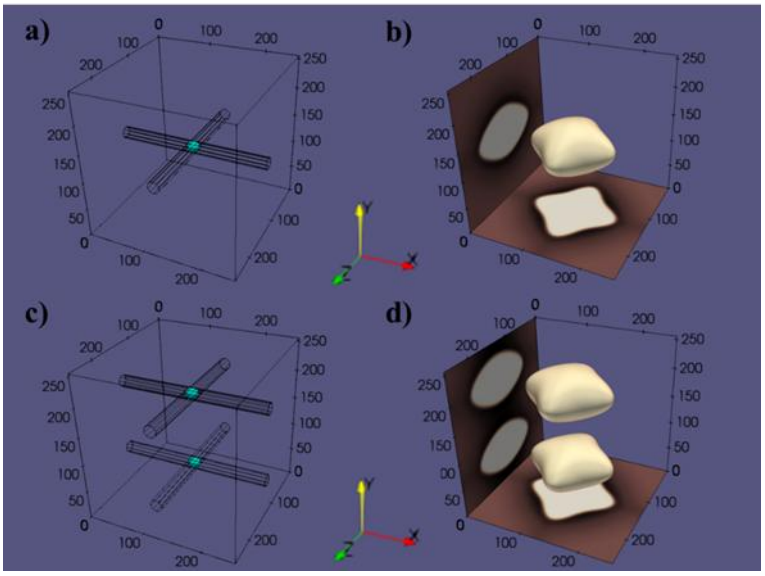

Fig.1 Single and two precipitates: (a) and (c) are at (non-dimensional) time t = 0 and (b) and (d) are at t = 800.

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