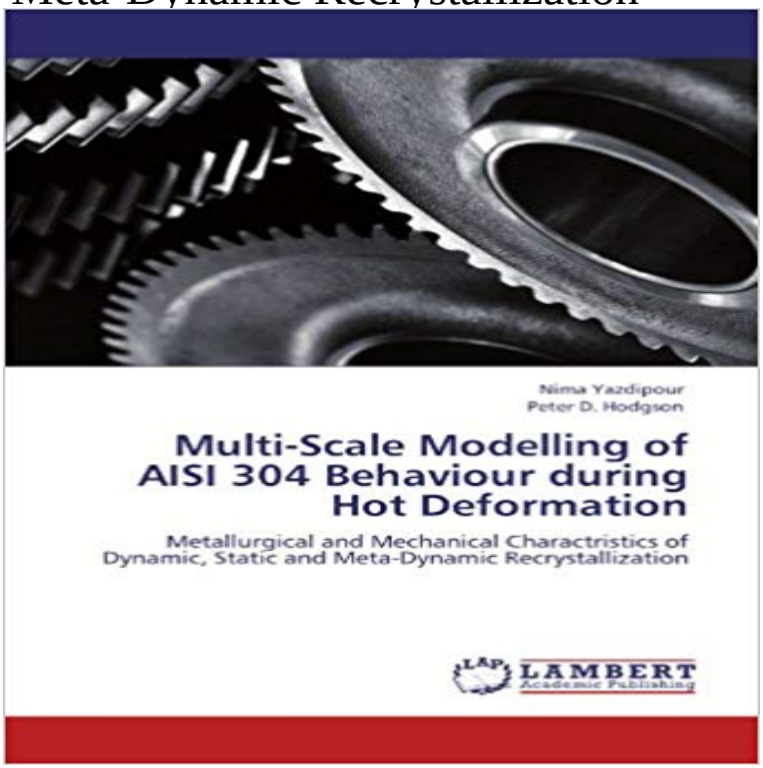
Multi-Scale Modelling of AISI 304 Behaviour during Hot Deformation: Metallurgical and Mechanical Charactristics of Dynamic, Static and Meta-Dynamic Recrystallization



Microstructure evolution during and following hot deformation was modeled using Cellular Automata (CA) technique. Dislocation annihilation during and following hot deformation, dynamic static and meta-dynamic (DRX, SRX and MDRX respectively), are considered using a 2D CA approach. The dislocation density was employed as the governing parameter to simulate the softening fraction. Kocks-Mecking approach was used to derive the dynamic recovery (DRV) curves. The flow curves, softening kinetics and final microstructures were modelled for different thermomechanical conditions (i.e. different Zener-Hollomon parameters, Z) and used as the input data for the post-deformation softening simulation to elucidate the effect of DRX on the post-deformation softening. The simulation results were compared with the experimental data from the hot torsion test of AISI 304 steel. The proposed model used a wide range of Zener-Hollomon parameter (Z) and predicted the final microstructure and softening kinetics curves. Consequently, the CA approach can predict the final microstructure, softening kinetics and flow curve successfully under the wide range of thermomechanical conditions.

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