DEFORMATION HETEROGENEITY AND MICROSTRUCTURE EVOLUTION IN COLD-ROLLED MULTI-PHASE STEELS: A 3D CRYSTAL PLASTICITY STUDY

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We explore deformation heterogeneity and microstructure evolution during the cold rolling of multi-phase steels using high-resolution, three-dimensional crystal plasticity simulations. Particular emphasis is placed on investigating the effects of initial uncertainties in material parameters and microstructures. A Fast Fourier Transform (FFT)-based spectral solver is employed to perform crystal plasticity simulations using a dislocation-density-based model. The results are compared with experimental data obtained from electron backscatter diffraction (EBSD) measurements. Notably, we highlight the connection between the formation of in-grain and macroscopic shear bands and the uncertainties present in the initial microstructure. Additionally, we examine the evolution of in-grain orientation gradients, misorientation features, dislocation density, kernel average misorientation, and stress within major texture components. This comprehensive analysis enhances our understanding of the variations in microstructure evolution during the cold rolling of multi-phase steels.