Multiscale hot-working simulations by MPFFE-DRX model

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Hot-working is a process where a metallic material is plastically deformed at an elevated temperature above its recrystallization temperature. Dynamic recrystallization (DRX) occurs during the hot-working of a metallic material with low-to-medium stacking-fault energy. In order to evaluate precisely the macroscopic mechanical behaviors affected by the microstructure evolution due to DRX, we developed the multi-phase-field and finite element dynamic recrystallization (MPFFE-DRX) model [submitted to Int. J. Plast.] where the multi-phase-field dynamic recrystallization (MPF-DRX) model [Mater. Trans., **49**(2008), 2559.] evaluates the microstructure evolution and the large deformation elastic-plastic finite element method evaluates the macroscopic mechanical behaviors. In this study, we simulate a hot-working with complex processing history where loaded and unloaded conditions occur simultaneously by using the MPFFE-DRX model. Here, we investigate the distribution of the equivalent stress, the equivalent strain rate and the average DRX grain size inside a material.

Keywords: Hot-working, Dynamic recrystallization, Multi-phase-field method, Finite element method, Multiscale simulation