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Modeling Periodic Adiabatic Shear Bands Evolution in a 304L Stainless Steel Thick-Walled Cylinder MINGTAO LIU, HAIBO HU, CHENG FAN, TIEGANG TANG, Institute of Fluid Physics, China Academy of Engineering Physics, Mianyang, Sichuan — The self-organization of multiple shear bands in a 304L stainless steel thick-walled cylinder (TWC) was numerically studied. The microstructures of material lead to the non-uniform distribution of local yield stress, which plays a key role in the formation of spontaneous shear localization. We introduced a probability factor satisfied Gauss distribution into the macroscopic constitutive relationship to describe the non-uniformity of local yield stress. Using the probability factor, the initiation and propagation of multiple shear bands in TWC were numerically replicated in our 2D FEM simulation. Experimental results in the literature indicate that the machined surface at the internal boundary of a 304L stainless steel cylinder provides a work-hardened layer (about 20 μm) which has significantly different microstructures from base material. The work-hardened layer leads to the phenomenon that most shear bands are in clockwise or counterclockwise direction. In our simulation, periodic oriented perturbations were applied to describe the grain orientation in the work-hardened layer, and the spiral pattern of shear bands was successfully replicated.

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