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MICROSTRUCTURAL EFFECTS ON EVOLUTION OF SHEAR LOCALIZATION IN PRE-STRAINED STAINLESS STEELS

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Abstract

Microstructual and processing effects on evolution of adiabatic shear localization (ASL) was systematically studied in various pre-strained stainless steels. Top hat sample impact on a split Hopkinson pressure bar was used. This well-controlled forced shear technique makes it possible to accurately correlate the microstructural evolution of ASL to the transient mechanical behavior. The initiation and development of adiabatic shear bands were captured and the material sensitivity to trigger a localized deformation was analyzed. The work-hardening rate was found to play a dominant role in ASL formation. The post mortem investigation of microstructure within and near shear bands using transmission electron microscopy (TEM) displays microstructural characteristics of shear band formation. The TEM results indicate that the main substructure inside a shear band consists of elongated lath, fine rectangular, and equiaxed subgrains. Dynamic/static recovery and continuous dynamic recrystallization were the main mechanisms to form the residual microstructure inside shear bands.

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