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Numerical Representation and Modeling of Adiabatic Shear Banding in Metals TAO JIN, HASHEM MOURAD, CURT BRONKHORST, VERONICA LIVESCU, Los Alamos Natl Lab — We will present an enriched element technique to represent the adiabatic shear banding process within a traditional Lagrangian finite element framework. A rate-dependent onset criterion for the initiation of a band is defined based upon a rate and temperature dependent material model. Once the bifurcation condition is met, the location and orientation of the embedded zone is computed and inserted at that Gauss point. Once embedded the boundary conditions between the localized and unlocalized regions of the element are enforced and the composite sub-grid element follows a weighted average representation of both regions. The material inside the band is able to be represented with a constitutive model independent from the outside material and the thickness of the band can be assigned by any appropriate method. In the finite strain formulation, rotation of the formed band is tracked with deformation. The process of dynamic recrystallization as an additional softening mechanism during the dynamic loading process is critical for some materials and a simple physically based representation of the structural recovery process is discussed. Both the initiation and growth of adiabatic shear banding is believed to be influenced by local structural features of a material and this talk will discuss the influence of the microstructure on this process. Experiments have been performed on 304L and 316L stainless steels and will be compared against numerical simulations to validate the performance of both the material model and computational approach. Remaining challenges will also be discussed.

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