Abstract Submitted
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Shear localization in 4340 steel with different microstructure using Thick Wall Cylinder method[1] PEDRO FRANCO NAVARRO, PO-HSUN CHIU, Univ of California - San Diego, ANDREW HIGGINS, MATTHEW SERGE, McGill University, DAVID BENSON, VITALI NESTERENKO, Univ of California - San Diego — Initiation and self-organization of shear bands in 4340 steel with initial low (2789 MPa) and high (5420 MPa) microhardnesses, but similar thermophysical properties, is studied using explosively driven Thick Wall Cylinder method and numerical simulations. In experiments low hardness 4340 steel demonstrated the initiation of a pattern of shear bands at global effective strain of about 0.53, which did not significantly change with increase of global strain up to 0.8. High microhardness 4340 steel demonstrated extremely different post-critical behavior. At global strain 0.56 a few well-developed shear bands propagated through the sample with their transformation into crack pattern at larger global strain 0.83. The propagation mechanism of shear bands in high hardness 4340 steel is explained by the interfacial microcracking between inclusions and matrix. Johnson-Cook material model with damage correctly predicted the dramatic change of shear bands pattern at similar global strains with change of initial properties of steel in numerical simulations. The pattern of shear bands was dependent on the number of initial material defects introduced by scaling of yield strength of mesh elements.

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