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The influence of mesostructural properties in concentric Ni-Al laminates on the accommodation of large plastic strain during high strain rate dynamic loading[1] KARL OLNEY, PO-HSUN CHIU, University of California, San Diego, ANDREW HIGGINS, MATTHEW SERGE, McGill University, DAVID BENSON, VITALI NESTERENKO, University of California, San Diego — Ni-Al laminates have been shown to be good candidates for use in reactive material systems due to their ability to release chemical energy via an intermetallic reaction initiated by thermal or mechanical stimuli. The Thick Walled Cylinder (TWC) technique allows for the testing and complete recovery of samples during a tunable high strain/strain rate plastic deformation process under plane strain conditions. Ni-Al laminates constructed from alternating concentric Ni (25.4 micron thickness) and Al (38.1 micron thickness) layers demonstrated that the cooperative buckling of layers was the dominant mode of plastic strain accommodation. Intermetallic reaction spots were observed in many of the apexes of these buckles. Alterations to mesoscale properties in these laminates using the TWC method help to understand the role of the mesostructural properties on the accommodation of plastic strain and possible development of intermetallic reaction. Finite element simulations show good agreement with the TWC experiments and provided insights into the evolution of the mesostructure during the collapse. These insights may be used to tailor the mesostructure to enhance the reactivity in the Ni-Al laminates.

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Karl Olney
University of California, San Diego

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