Small Scale Experiments to Support Strength and Damage Modeling

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Abstract

The limited understanding of the stochastic way in which polycrystalline materials deform, damage, and fail prevents accurate prediction of their performance. Understanding how these processes occur allows for prediction of their response in service and can ultimately lead to the design of new, more failure resistant materials. Characterization of these processes can be difficult, particularly within the dynamic strain rate regime, due to limitations in experimental platforms, in-situ diagnostics, and our understanding of path dependent processes. In this talk, current studies to investigate dynamic damage evolution in bulk metals will be discussed. Through the use of novel wave shock wave shaping experiments and combinations of dynamic test platforms (gas guns, laser shock and direct high explosive drive), the kinetic and spatial effects on dynamic damage can be examined. Soft recovery of these specimens enables post mortem characterization. In this way, relationships can be established between initial microstructures, stress state, strain rate, and evolving damage. Quantification of these relationships is necessary to advance the physics of damage models and therefore enhance predictive capability.

Biosketch

Ellen Cerreta has been a Technical Staff Member at Los Alamos National Laboratory within Structure/Properties Relations Group of the Materials Science and Technology Division since January 2003. Prior to that, she was a Post Doctoral Fellow within the same division. Ellen Cerreta received her BS in Aerospace Engineering from The University of Virginia. She received her Ph.D. in Materials Science and Engineering from Carnegie Mellon University in 2001, on the thesis topic of “Substructural Evolution of Creep Deformed Titanium Aluminides”. Since coming to Los Alamos, she has worked on the mechanical behavior and characterization of metals and alloys, with the support of BES, the national defense and energy programs, and Laboratory Directed Research and Development (LDRD). This work has resulted in over 50 peer reviewed publications and numerous collaborations. She is co-lead for the High Strain Rate Thrust in the Center for Materials in Irradiation and Mechanical Extremes EFRC. Recently, Ellen has assumed the role of co-PI for an LDRD/DR project, “Isolating the Influence of Kinetic and Spatial Effects on Dynamic Damage”. She is a member of the Board of Directors (Membership Director) of The Minerals, Metals, and Materials Society, and received their International Scholar Award in 2006.

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