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In Situ Imaging during Compression of Plastic Bonded Explosives for Damage Modeling[1] JOHN YEAGER, VIRGINIA MANNER, BRIAN PATTERSON, DAVID WALTERS, NIKOLAUS CORDES, KEVIN HENDERSON, BRYCE TAPPAN, DARBY LUSCHER, Los Alamos National Laboratory — The microstructure of plastic bonded explosives (PBXs) is known to influence behavior during insults such as deformation, heating or initiation to detonation. Obtaining three-dimensional microstructural data can be difficult due in part to fragility of the material and small feature size. X-ray computed tomography (CT) is an ideal characterization technique but the explosive crystals and binder in formulations such as PBX 9501 do not have sufficient x-ray contrast to differentiate between the components. Here, we have formulated several PBXs using octahydro-1,3,5,7-tetranitro-1,3,5,7- tetrazocine (HMX) crystals and low-density binder systems. The full three-dimensional microstructure of these samples has been characterized using microscale CT during uniaxial mechanical compression in an interrupted in situ modality. The rigidity of the binder was observed to significantly influence fracture, crystal-binder delamination, and material flow. Additionally, the segmented, 3D images were meshed for finite element simulation. Initial results of the mesoscale modeling exhibit qualitatively similar delamination.

[1]Los Alamos National Laboratory - LDRD

John Yeager
Los Alamos National Laboratory

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