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Dislocations and Dynamic Yield of RDX Single Crystals[1]

DANIEL HOOKS, Los Alamos National Laboratory

To further understand the role of dislocations in the dynamic yield point and shock initiation of single crystals of explosives, shock wave loading experiments were performed on the (100), (210), and (111) planes of RDX at impact stresses of about 1GPa. Defect content in the crystals and the surface polishing technique were varied and the resulting materials were characterized by polarized light, differential interference contrast, and scanning probe microscopy. In previous experiments on (100) oriented crystals, multiple elastic peaks were thought to be due to cracks in specific directions introduced during experiment assembly; experiments were performed to try to reproduce these features on other crystal orientations by deliberately choosing crystals with voids and poorer surface finish. The multiple elastic steps are discrete events potentially caused by one or more defects that eventually lead to a disperse elastic-plastic transition as observed in randomly oriented powders or perhaps sufficiently defective single crystals. To understand the relative importance of discrete crystal plasticity we have begun nano-indentation experiments on the crystals demonstrating plastic yielding without fracture in RDX, a technique tested using the simulant sucrose.

[1]In collaboration with Kyle Ramos, Los Alamos National Laboratory and David Bahr, Washington State University.