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Phase Contrast Imaging of Damage Initiation During Ballistic Impact of Boron Carbide BRIAN SCHUSTER, ANDREW TONGE, US Army Research Laboratory, KYLE RAMOS, Los Alamos National Laboratory, PAULO RIGG, Washington State University, ADAM IVERSON, NSTec, ADAM SCHUMAN, Washington State University, NICHOLAS LORENZO, Oak Ridge Institute for Science and Education — For several decades, flash X-ray imaging has been used to perform time-resolved investigations of the response of ceramics under ballistic impact. Traditional absorption based contrast offers little insight into the early initiation of inelastic deformation mechanisms and instead typically only shows the gross deformation and fracture behavior. In the present work, we employed phase contrast imaging (PCI) at the Dynamic Compression Sector (DCS) at the Advanced Photon Source, Argonne National Laboratory, to investigate crack initiation and propagation following the impact of copper penetrators into boron carbide targets. These experiments employed a single-stage propellant gun to launch small-scale (0.6 mm diameter by 3 mm long) pure copper impactors at velocities ranging from 0.9 to 1.9 km/s into commercially available boron carbide targets that were 8 mm on a side. At the lowest striking velocities the penetrator undergoes dwell or interface defeat and the target response is consistent with the cone crack formation at the impact site. At higher striking velocities there is a distinct transition to massive fragmentation leading to the onset of penetration.

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