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Spall and re-compaction in OFHC copper under high velocity impact

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A research project to study spall and subsequent re-compaction of oxygen-free high thermal conductivity (OFHC) copper has begun using a single stage large bore (76.2 mm) light gas gun capable of planar impacts. This work was motivated by the recent results from Turley et. al[1] using explosive drive, and the previous research of Becker et. al[2]. Gun experiments were done to produce an initial spall in the target with a re-compaction occurring to close the spall damage/layer (i.e. void closure) by use of a layered flyer plate. Symmetric spall experiments at similar conditions were also conducted as a control to the re-compaction experiments. Photonic Doppler Velocimetry (PDV)[3] was used to obtain the velocity history of the back surface of the target, for analysis and comparison with numerical simulations. The copper targets were recovered for eventual analysis of the resulting microstructure using optical imaging microscopy (OIM) and Electron Backscatter Diffraction (EBSD). A re-compaction wave was clearly observed in the PDV data obtained at the back surface of the copper target. A metallurgical feature was also observed in the recovered samples. Time-resolved data will be presented and discussed, as will the microstructural analyses of the recovered samples. Investigating the phenomenon of re-compaction will provide a better understanding of material deformation and can be used to improve the available numerical simulation codes. 1. Turley, W.D., et al., Explosive-induced shock damage in copper and recompression of the damaged region, J. App. Phy. 120, 085904 (2006). 2. Becker, R., et al., Characterization of recompressed spall in copper gas gun targets, J. App. Phy. 102, 093512 (2007). 3. Strand O.T., et al., Compact system for high-speed velocimetry using heterodyne techniques. Review of Scientific Instruments. 77, 083108 (2006). This work was done by MSTS LLC, under Contract No. DE-NA0003624 with the US DOE, and supported by the SDRD Program. DOE/NV/03624—0387.

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