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Strength and Micro-strain Distribution of Shock Compressed Aluminum Single Crystals Determined from Real-time X-ray Diffraction STEFAN TURNEAURE, Y.M. GUPTA, Washington State University — Shock compressed Al(100) single crystals were examined using x-ray diffraction (XRD) and velocity interferometry. Mo Kα x-rays were used to obtain high resolution XRD measurements of the Al 200, 400, and 600 peaks. The XRD measurements were obtained at the rear surface of the Al after a partial stress release due to reflection of the plastic wave at an Al/vitreous carbon interface. Analytic methods were developed to determine macroscopic strength and local micro-strain distributions from XRD measurements and were applied to the Al(100) XRD data. The Al crystals are shown to strain harden; for the highest stress experiment (12.7 GPa Al input stress and 7.1 GPa reflected stress), the strength is 0.52 GPa compared to a strength of 0.025 GPa at the HEL. The distribution of local micro-strains is used to estimate the distribution of local maximum stress differences. The FWHM of the distribution of local maximum stress differences is about 50% of the macroscopic stress difference (or strength) for shock compressed Al(100). Work supported by DOE/NNSA.

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