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Dynamic Strength Properties of Single Crystal Iron¹ SARAH A. THOMAS, ROBERT S. HIXSON, Mission Support and Test Services, BRANDON M. LALONE, GERALD D. STEVENS, WILLIAM D. TURLEY, Special Technologies Laboratory — The dynamic properties of single crystal metals, including anisotropic dynamic properties, have not been extensively studied. Single crystal metal research is motivated by a need to better understand directional properties and how these properties influence the polycrystalline metal. We chose to study iron because of its relatively high anisotropy ratio of $A = 2.34$, which causes distinct directional differences in elastic properties. Our ultimate research goal is to examine the dynamic properties of single crystal iron in the three principal orientations: [100], [110], and [111]. We have conducted gas gun experiments in which 1018 cold rolled steel and single crystal iron flyer plates impacted single crystal iron targets in the [100] direction at nominally 300 m/s. The resulting velocimetry plots show elastic yield behavior that is much different than that of polycrystalline iron. The single crystal data show a marked overshoot and subsequent relaxation of the elastic wave, rather than a single yield stress, as seen in polycrystalline iron. The reasons for this difference will be discussed. Additionally, comparisons will be made between yield stresses in dynamic and static experiments.

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