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The Young's modulus of 1018 steel and 6061-T6 aluminum measured from quasi-static to elastic precursor strain-rates PHILIP RAE, CARL TRUJILLO, RUSTY GRAY, LANL — It is commonly assumed in engineering and physics that the elastic moduli of metals is independent of strain-rate, but is a weak function of temperature. An extensive literature search however has failed to find any citable reference in which the Young's modulus of any pedigreed metal was measured over a wide variety of strain-rates. To rectify this, samples of pedigreed 1018 steel and 6061-T6 aluminum have been tested at strain-rates from 10^{-4} s^{-1} to 10^{6} s^{-1}. Low strain-rate data ($10^{-4} - 10^{-2}$ s^{-1})was obtained from commercial bonded strain gauges. Intermediate rate data ($\approx 10^{-4}$ s^{-1}) was obtained from time of flight ultrasonic measurements. Shock rate data was obtained by examining the elastic precursor using shock pins and PDV (photonic Doppler velocimetry). Correction for the adiabatic versus thermal nature of the disparate strain-rate regimes have been made. Additionally, the implications of the uniaxial strain nature of the shock elastic precursor are examined with respect to comparison with uniaxial stress lower rate data.

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