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Calibrating Strain Rate Dependence of Viscoplastic Flow from Fourth Power Law Data YEHUDA PARTOM, RAFAEL — The standard way of parametrizing a steady structured shock is by plotting the stress jump across the wave ($\Delta\sigma$) versus its maximum strain rate ($\dot{\varepsilon}$) on a logarithmic plot. Doing so one usually gets a straight line, which means that$\dot{\varepsilon} \propto (\Delta\sigma)^{\beta}$. Grady and coworkers noticed in the 1980s that for many materials β=4. Since then several workers in the field tried to understand this unusual behavior, but no satisfactory explanation was found. Recently Grady revisited the fourth power law with an extensive review, including descriptions of the various mechanisms proposed as possible explanations. In view of this background we use here the fourth power law to calibrate the strain rate component of the constitutive response of Al 6061-T6. To this end we integrate the steady viscoplastic equations (developed long ago) from the elastic precursor level to the stress plateau level. We find that the plastic deformation rate has to depend on the deviator overstress by $\dot{d}^p \propto \left(s - \frac{2}{3}Y\right)^{\alpha}$ with α=2.38. But for high shock levels, when the elastic precursor is overdriven, using this value of α leads to a higher value of the slope β, close to β=6.

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