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Critical conditions for failure; stress levels, length scales, time scales

NEIL BOURNE, University of Manchester

There is a range of thresholds for the response of condensed matter under loading in compression, from the yield point to that at which the bond strength is overcome and warm dense matter is formed. Yield stress shows a correlation between the length scale swept by the rise of the pulse and the defect distribution within the target for a range of materials. Strain rate is also a useful term that reflects the evolution of the stress state within a target but must also be defined for a volume element containing a particular defect distribution to reflect continuum conditions acting within and thus applies to a defined length scale within a target. Examples are shown using shock pulses to spall metal targets. Different stacking shows differing behaviour yet in each case momentum is conserved. This overview of behaviour suggests concepts borrowed from rate-independent plasticity may be viewed in a different manner and accompanying behaviours such as brittle-ductile transition may be reviewed when explaining a range of dynamic failure modes under load for materials and structures.