

DYNAMIC STRAIN LOCALIZATION AND FRAGMENTATION

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Abstract:

The tensile constitutive and failure behavior of ductile metals at high strain-rates - between 1000 and 15000 per second - is considered. An electromagnetically driven expanding ring/tube experiment is used as the primary tool for examining the material behavior in this range of strain rates. The details of the experimental design, diagnostic methods and interpretation of the localization and fragmentation will be discussed. Mechanistic and statistical aspects of strain localization and fragmentation, modeled through conventional elasto-plastic theory and the idea of the Mott release waves, will be described. Similarities and differences between quasi-static and dynamic localization will be explored through variation of specimen geometry, size and inherent material properties. Application of the idea to blast protection of structures and to manufacturing processes will be discussed as the primary motivating problems.