

A STUDY ON SPONTANEOUS ADIABATIC SHEAR BAND FORMATION IN ELECTRO-MAGNETICALLY COLLAPSING CYLINDERS

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ABSTRACT

The formation of shear bands in collapsing thick-walled cylinders (TWC) occurs in a spontaneous manner. The advantage of studying spontaneous, as opposed to forced, shear localization, is that it highlights the *inherent susceptibility* of the material to adiabatic shear banding without prescribed geometrical constraints. In the case of spontaneous shear localization, the role of microstructure (grain size and grain boundaries) on localization, is still unresolved. Using an electro-magnetic set-up, for the collapse of thick-walled cylinders, we examined the shear band formation and evolution in seven metallic alloys, with a wide range of strength and failure properties. To assess microstructural effects, we conducted systematic tests on copper and Ti6Al4V with different grain sizes. Our results match quite well previously reported data on much larger specimens, showing the absence of a size effect, on adiabatic shearing. However, the measured shear band spacing, in this study, do not match the predictions of existing analytical models, indicating that the physics of the problem needs to be better modeled.

