



DTE – Dynamic Tensile Extrusion: a new experimental technique for the validation of constitutive modeling

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ABSTRACT. Recently, Gray *et al.* (AIP Conf. Proc., 845, pp.725-728, 2006) proposed a new experimental technique, called Dynamic-Tensile-Extrusion (DTE), where a spherical projectile is launched against an open conical die. Since the exit diameter of the die is smaller than the sphere diameter, the projectile experiences severe plastic deformation in dynamic tension at high strain rates. Preliminary results reported by Gray *et al.* seem to indicate that the effect of microstructural features (such as grain size, inclusion content, texture, etc.) on the overall material response can be considerable in this experiment. Therefore, there is an interest in understanding the governing parameters of this type of test (stress triaxiality evolution, stress wave interaction, friction, etc.) for a potential use in the material constitutive and damage modeling qualification.

In this work the DTE has been investigated using numerical simulation. As a result of the large plastic deformation, the test configuration poses several challenges from the computational point of view such as temperature, strain rate, strain hardening, and mesh distortion effects. Different numerical formulations have been used to simulate this test. CTH, an Eulerian finite volume code, and MSC.MARC 2007R1, a commercial finite element code using direct integration scheme, have been used to compare and integrate the advantages offered by both formulations.

Parallel to this, DTE tests have been performed on high purity copper to validate the computational results. The possibility to modify the geometry configuration of the DTE using a rounded-nose cylindrical projectile, alternatively to a sphere, has also been investigated, and the preliminary results are reported in this work.

KEYWORDS. Shock; Impact; High strain rates; Constitutive modeling; Cu.
