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Validation of Johnson-Cook Plasticity and Damage Model using Impact Experiment

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ABSTRACT

The validity of the Johnson-Cook constitutive relation and failure criterion at high strain-rates, up to ~10^6 s^{-1}, was assessed by predicting the dynamic response of Ti-6Al-4V under high speed ball impact at various velocities and angles. White light scanning was performed to characterize impact craters formed on target surfaces. The measured crater was compared with that predicted by the corresponding finite element model developed using the finite element code Abaqus/Explicit. The target material behavior was modeled by the Johnson-Cook material model that induced both plastic deformation and damage mechanism. Good agreement was obtained between the experimental measurements and numerical predictions for all testing conditions.

Keywords: Johnson-Cook, impact, high strain rate, foreign object damage

1. Introduction

Metal deformation and rupture under impact loading is a complex and dynamic process, always involving high plastic strains as well as large changes in strain rates. The Johnson-Cook (J-C) material model has been widely used to model impact and

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