

A Constitutive Model for the Compaction of Metal Powders

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1 Abstract

This paper addresses the constitutive behavior associated with the rate-independent compaction of metal powder. The compaction constitutive behavior of a simple model material, Hoeganaes MH-100, is characterized. The material data is then compared with a model for rate-independent compaction proposed by Doraivelu, et al. [1984]. The Doraivelu model with the addition of elasticity has been incorporated using a finite deformation formulation into the finite element code ABAQUS. The results of an experimental compaction operation is then compared with the predictions obtained from a finite element simulation.

2 Introduction

The consolidation of powder materials is becoming an increasingly popular near net shape processing technique. Consolidation of powder precursors permits both the fabrication of complex part geometries and the creation of complex material microstructures which in some instances can not be created by any other technique. Many materials, such as refractory metals, rapidly solidified metals, intermetallics, and ceramics, frequently require some form of stress-assisted consolidation as part of their processing history. The mechanics