LA-UR- 04-0838

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Title: ANOMALOUS MASS TRANSPORT IN AU/304 STAINLESS POWDER UNDER SHOCK LOADING

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Submitted to: FIFTH PACIFIC RIM INTERNATIONAL CONFERENCE ON ADVANCED MATERIALS AND PROCESSING, BEIJING, CHINA, NOVEMBER 2-5, 2004

Abstract to be submitted for the Fifth Pacific Rim International Conference on Advanced Materials and Processing, Beijing, China, November 2-5, 2004

Invited paper in session [T] Layered and Graded Materials; Combustion Synthesis

Anomalous Mass Transport in Au/304 Stainless Steel Powder Under Shock Loading

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Abstract

Dynamic deformation experiments on gold plated 304L stainless steel powders were undertaken using a axial symmetrical implosion geometry. These experiments utilized pressures of 0.08 to 1.0 Mbar and contained a symmetric radial melt region along the central axis of the sample holder. To understand the role of deformation in a porous material, the pressure, and temperature as well as the deformation heat and associated defects must be accounted for. Using a strain controllable shock loading design it was possible to separate and control independently strain and pressure. Thus enabling the ability to control the added heat from the deformation process undergoing compaction/consolidation of the powder. When the added heat of consolidation deformation exceeds the melt temperature of the 304 powders, a melt zone results that can consume large regions of the compact. It is within these regions that very high diffusion of gold into the powder occurs. These anomalous increases have been observed via optical microscopy, scanning electron microscopy and EDAX measurements. Values exceeding 1200 m/sec have been measured and correlated to the powder sizes, size distribution and packing density, concomitant with sample container strains ranging from 2.0% to 26%.