Materials Science Forum Vols. 828-829 (2015) pp 121-128

Analysis of the Cold Compaction Behaviour of TiH2-316L Nanocomposite Powder Blend using Compaction Models

Christopher Machio[1,a*], Ronald Machaka[1,b], Thembinkosi Shabalala[2,c], and Hilda K. Chikwanda[1,d]

[1]Light Metals, Titanium Centre of Competence, Materials Science and Manufacturing, Council for Scientific and Industrial Research, P.O. Box 395, Pretoria 0001, RSA,
[2]Diamond Research Laboratory, Element Six (SA), 1 Debid Rd, Nuffield, Springs 1655, RSA

[a]cmachio@csir.co.za

Abstract

The paper captures the effect of structure and the applicability of compaction models using the cold compaction of a TiH_2-SS316L composite powder prepared by high energy mechanical milling. The composite blend was cold pressed uniaxially to pressures of up to 1250MPa. The compressibility of the composite blend was evaluated by fitting the experimental data to the most commonly used compaction models of Heckel, the Kawakita-Lüdde, the Cooper- Eaton, the Ge, and the Panelli-Filho compaction equations. Among the models, the Kawakita-Lüdde and Cooper-Eaton models fitted the experimental data very well with a good correlation (the correlation coefficient greater than 0.99) throughout the entire pressure range under investigation. The nature and mechanisms responsible for the densification during cold compaction are discussed. The Heckel, Ge, Panelli-Filho, and Cooper-Eaton model analysis showed that the dominant compaction mechanisms for composite blend were rearrangement of particles followed by elastic and plastic deformation. The results are discussed by way of a comprehensive model intercomparison study of the cold compaction behaviour using existing models.