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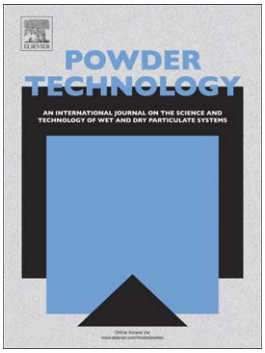

Powder distribution on powder injection moulding of ceramic green compacts using thermogravimetric analysis and differential scanning calorimetry

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Abstract

Powder-binder separation during injection moulding causes defects such as cracking, warpage or anisotropic shrinkage during firing. In this paper, thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) that were previously used to analyse powder distribution within the green body for metal injection moulding are used for ceramics. TGA and DSC are used to characterise the mass loss and heat of fusion of the binder system, silicon nitride feedstock and test-bars. TGA can measure the volume fraction of powder in green parts directly with 1.76 vol% difference from nominal volume fraction and variations up to 0.177 vol%. The DSC empirical model predicted volume fraction of powder in green parts with 1.76 vol% difference from nominal volume fraction and variations up to 1.710 vol%. Using rule of mixture, it over predicted volume fraction of powder in green parts by 6.78 vol% from nominal volume fraction and with variations up to 2.510 vol%.

1. Introduction

Powder injection moulding (PIM) is a combination of plastic injection moulding and powder metallurgy processes such as compounding, moulding, debinding and sintering. Defects have been known to arise during any stage of the PIM process including poor dispersion of powder and binder during compounding, surface and structural defects from injection moulding, deformation and cracking during debinding and anisotropic shrinkage, cracking and warpage during sintering [1-9]. These defects that emerges during moulding cannot be resolved in the latter process [3, 10, 11]. Separation between powder and binder has been identified as one of the causes of such defects and it occurs due the

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