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Advantages of Combined Sintering Compared to Conventional Sintering of Mechanically Activated Magnesium Titanate

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Abstract:

In this article, the advantages of combined sintering in comparison with the conventional one, of mechanically activated magnesium titanate ceramic were investigated. The stoichiometric mixtures of MgO and TiO_2 were mechano-chemically activated for 0, 10, 40, 80 and 160 minutes by ball milling and then isostatically pressed (CIP) to form green bodies. Conventional sintering was realized by heating up to 1400 ^oC and hold for 30 minutes in air atmosphere. Resulting ceramic samples with closed porosity were post-sintered by pressure assisted technique Hot Isostatic Pressing (HIP) at 1280 ^oC/3h in argon atmosphere with a pressure of 200 MPa. The best results were observed in the case of samples post-sintered by HIP, when single-phase $MgTiO_3$ samples with relative density of 96% were prepared.

Keywords: *Sintering, Ceramics, Magnesium titanate.*

1. Introduction

In the fabrication of ceramic components, important achievement is to reach full or almost full density of ceramics. In the last decades quite large number of sintering techniques besides conventional sintering method was developed. Consolidation of ceramic green bodies by these techniques (e.g. spark plasma sintering, microwave sintering, two step sintering) are preferably used for materials, which processing is difficult because of the unsuiTab. microstructure, final density or phase purity point of view.[1-5]

Magnesium titanate is a ceramic material widely used as resonators, filters and antennas for communication systems operating at microwave frequencies and capacitors.[6,7] In the literature, various methods for $MgTiO_3$ fabrication were presented, such as solid-state reactions, co-precipitation or sol–gel route.[6,8,9] Few secondary phases were often detected along with $MgTiO_3$ phase ($MgTi_2O_5$, Mg_2TiO_4).[10-12] Preparation of pure $MgTiO_3$ by solid state reaction was the aim of many papers. Magnesium titanate obtained by sintering process without additives reached density values less than 95% of TD. [13]

In order to improve properties of ceramics, it is desirable to achieve microstructures with nearly full density and fine grains with homogenous distribution. Along with powder

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