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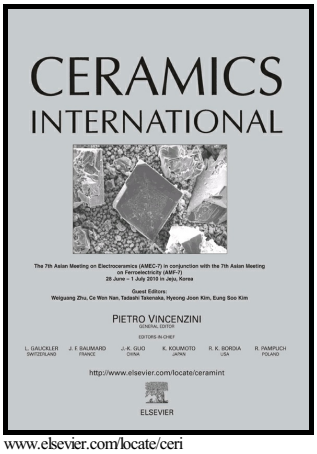

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PII: S0272-8842(17)30091-3
DOI: http://dx.doi.org/10.1016/j.ceramint.2017.01.079
Reference: CERI14541

To appear in: *Ceramics International*

Received date: 7 November 2016
Revised date: 9 November 2016
Accepted date: 16 January 2017

Cite this article as: Yuta NAKAGOSHI and Yoshikazu SUZUKI, Dimensional change behavior of porous $MgTi_2O_5$ in reactive sintering, *Ceramic International,* http://dx.doi.org/10.1016/j.ceramint.2017.01.079

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Dimensional change behavior of porous $MgTi_2O_5$ in reactive sintering

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Abstract

Volume-shrinkage of a sample in reactive sintering generally tends to be larger than that in conventional sintering. New techniques to suppress the volume shrinkage are eagerly needed for actual manufacturing. Recently, we have reported that reactively sintered porous $MgTi_2O_5$ from hydromagnesite and TiO_2 rutile showed less volume shrinkage than that from hydromagnesite and TiO_2 anatase. The result demonstrated that the compositional control of starting polymorphs can be a potential technique to optimize the volume shrinkage. In this paper, in order to evolve the reactive sintering technique, volume-changes during reactive sintering were dynamically monitored by thermomechanical analysis (TMA). The dimensional change behavior measured by TMA was linked up with the reaction behavior clarified by high-temperature X-ray diffraction (HT-XRD). In dilatometry curves, transient volume expansions were observed and they were well-explained by the formation and crystal growth of intermediate $MgTiO_3$ and objective $MgTi_2O_5$ particles.

Keywords: A. Powders: solid state reaction; A. Sintering; B. Porosity; C: Thermal expansion; $MgTi_2O_5$; Reactive sintering

1. Introduction

Porous ceramics are light, chemically stable and highly thermal resistant, which have been widespread in aerospace, energy and environment fields as a light-weight high-temperature structural material. In the environmental field, diesel particulate filters (DPFs) and honeycombs carriers for automobiles were prime examples. Orthorhombic pseudobrookite-type ceramics generally have relatively low bulk thermal expansion [1-3]; the pseudobrookite-type crystal structure has anisotropic thermal expansion, which induces inter- and intragranular microcracks in bulk polycrystals, resulting low bulk thermal expansion. Aluminum titanate (Al_2TiO_5) has been eagerly studied among pseudobrookite-type ceramics due to its low bulk thermal expansion. However, Al_2TiO_5 is metastable below 1200°C, so that Al_2TiO_5 tends to decompose into Al_2O_3 and TiO_2 rutile [4]. As an alternative pseudobrookite-type compound, we have

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