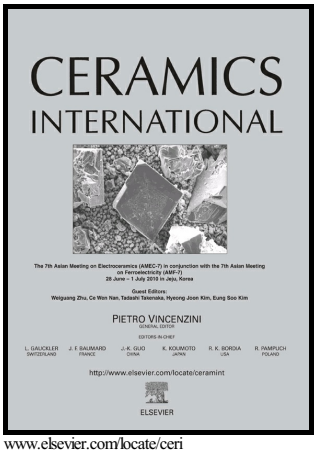

www.elsevier.com/locate/ceri

Structural study of mullite based ceramics derived from a mica-rich kaolin waste

Hugo P.A. Alves, Rubens A. Junior, Liszandra F.A. Campos, Ricardo P.S. Dutra, João P.F. Grilo, Francisco J.A. Loureiro, Daniel A. Macedo

PII: S0272-8842(16)32284-2
DOI: http://dx.doi.org/10.1016/j.ceramint.2016.12.035
Reference: CERI14345

To appear in: *Ceramics International*

Received date: 14 October 2016
Revised date: 22 November 2016
Accepted date: 6 December 2016

Cite this article as: Hugo P.A. Alves, Rubens A. Junior, Liszandra F.A. Campos, Ricardo P.S. Dutra, João P.F. Grilo, Francisco J.A. Loureiro and Daniel A. Macedo, Structural study of mullite based ceramics derived from a mica-ric kaolin waste, *Ceramics Internationa* http://dx.doi.org/10.1016/j.ceramint.2016.12.035

Structural study of mullite based ceramics derived from a mica-rich kaolin waste

Hugo P. A. Alves[a], Rubens A. Junior[a], Liszandra F. A. Campos[a], Ricardo P. S. Dutra[a]
João P. F. Grilo[b], Francisco J. A. Loureiro[c], Daniel A. Macedo[a*]

[a]Materials Science and Engineering Postgraduate Program, LSR, UFPB, 58051-900 João Pessoa, Brazil
[b]Department of Materials and Ceramic Engineering, University of Aveiro, 3810-193 Aveiro, Portugal
[c]Department of Mechanical Engineering, University of Aveiro, 3810-193 Aveiro, Portugal

[*]Corresponding author. Tel.: +55 83 3221-0289. damaced@gmail.com

Abstract

Mullite-based ceramics have been synthesized by reactive sintering of a mixture containing kaolin and a mica-rich kaolin waste. Samples fired in the temperature range from 1300 to 1500 °C were characterized by X-ray diffraction (XRD). The quantitative phase analysis and unit cell parameters of the mullite were determined by Rietveld refinement analysis of the XRD data. Mullite-based ceramics with 1.2 wt.% quartz, 56.3 wt.% glass (amorphous phase), 2.64 g/cm^3 of apparent density, and 35 ± 1.2 MPa of flexural strength were obtained after firing at 1500 °C. A liquid phase sintering mechanism activated by a total mica content of 13.3 wt.% allowed to increase the mullite content to 47.6 wt.% (2.3 wt.% quartz and 50.1 wt.% glass phase) and improve the flexural strength (70 ± 3.9 MPa) after firing at 1400 °C.

Keywords

A. Powders: solid state reaction; A. Sintering; D. Mullite; kaolin waste.

1. Introduction

Mullite ($3Al_2O_3.2SiO_2$) is one of the most important refractory ceramic materials. This material can be synthesized by reactive sintering (solid state reaction) of natural or synthetic raw materials such as clays, kaolin, alumina, aluminum isopropoxide, and fly ash. The mullitization process (mullite formation reaction) by reactive sintering is a thermally activated process that takes place through ionic diffusion of Al^{+3} and Si^{+2} (in a silico-aluminous mixture) at temperatures usually above 1300 °C [1-6]. Besides the above mentioned raw materials, kaolin waste (an