

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



www.elsevier.com/locate/ceri

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-rich kaolin waste, *Ceramics International*, <http://dx.doi.org/10.1016/j.ceramint.2016.12.035>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

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

Hugo P. A. Alves<sup>a</sup>, Rubens A. Junior<sup>a</sup>, Lizandra F. A. Campos<sup>a</sup>, Ricardo P. S. Dutra<sup>a</sup>  
João P. F. Grilo<sup>b</sup>, Francisco J. A. Loureiro<sup>c</sup>, Daniel A. Macedo<sup>a\*</sup>

<sup>a</sup>Materials Science and Engineering Postgraduate Program, LSR, UFPB, 58051-900 João Pessoa, Brazil

<sup>b</sup>Department of Materials and Ceramic Engineering, University of Aveiro, 3810-193 Aveiro, Portugal

<sup>c</sup>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<sup>3</sup> 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<sub>2</sub>O<sub>3</sub>·2SiO<sub>2</sub>) 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<sup>3+</sup> and Si<sup>4+</sup> (in a silico-aluminous mixture) at temperatures usually above 1300 °C [1-6]. Besides the above mentioned raw materials, kaolin waste (an

Download English Version:

<https://daneshyari.com/en/article/5438954>

Download Persian Version:

<https://daneshyari.com/article/5438954>

[Daneshyari.com](https://daneshyari.com)