



Sinterability and thermal properties of cordierite ceramics prepared from Algerian kaolinite and magnesium hydroxide

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ABSTRACT

In this paper, we investigate the effect of MgO additions on the formation and densification behaviour of the cordierite obtained from some mixtures of Algerian kaolin and magnesium hydroxide. The sintering properties of these compositions have been evaluated by X-ray diffraction and bulk density. XRD analysis revealed that the major phase of the synthesized ceramics was cordierite along with a trace of spinel. Firing the pressed specimens at 1400°C for 1 hour yielded a dense cordierite ceramics with a relative density higher than 96%, a negligible open porosity and a lower linear thermal expansion coefficient of $2.73 \times 10^{-6} \text{ K}^{-1}$ between 200 and 800°C. Cordierite due to its very low coefficient of thermal expansion is considered as promising candidate for advanced applications.

KEYWORDS

Kaolin; Cordierite; Spinel; Sintering; Thermal properties

I. Introduction

Cordierite ($2\text{MgO} \cdot 2\text{Al}_2\text{O}_3 \cdot 5\text{SiO}_2$) ceramics present have low thermal conductivity, low dielectric constant [1,2] and excellent thermal shock resistance due to their low thermal expansion coefficient (from $2 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$ to $6 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$) [3,4,5]. They are widely used as a material in Kiln furniture, honey comb-shaped catalysts carriers in automobile exhaust systems and substrates in the micro electric applications [6,7]. The excellent properties exhibited by kaolin-based cordierite system make them suitable for the fabrication of catalyst support. Cordierite ceramics used for some applications need to have high density and good mechanical properties. However, cordierite is difficult to sinter without sintering aids because of the sintering temperature range which is just before its incongruent melting point [6]. Therefore, some appropriate methods were having been developed to prepare these ceramics. It is well known that sol-gel method has the advantage of an excellent control of chemical composition and the possibility of reducing the sintering temperature [8,9]. Addition of some sintering aids is another way to obtain high density cordierite materials at relative low temperature. The purpose of the present works is to study the effect of MgO additions on the formation and densification behavior of cordierite obtained from Algerian kaolinite.