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Authors: A. Ramezani, S.M. Emami, S. Nemat



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Reuse of Spent FCC Catalyst, Waste Serpentine and Kiln Rollers Waste for Synthesis of Cordierite and Cordierite-mullite ceramics

A. Ramezani¹, S. M. Emami², S. Nemat³

1. Arak Refractories Company, Arak, Iran

2. Ceramic Department, Materials and Energy Research Center (MERC), Karaj, Iran

3. Department of Materials, Imam Khomeini International University, Qazvin, Iran

Highlights

- The hazardous spent FCC converted to applicable cordierite ceramic.
- The cordierite and cordierite-mullite ceramics were synthesized by 3 waste sources.
- The properties of the final samples are comparable to industrial products.
- The negative thermal expansion for the cordierite samples is a special result.

Abstract

Spent fluid catalytic cracking (FCC) was gathered from several petrochemical plants and calcined in a rotary furnace between 1000 and 1100°C in order to remove sulphur and hydrocarbon based impurities. Calcining process on FCC led to formation of AlVO_4 ceramic phase, so converted the hazardous waste to non-hazardous applicable raw material. In this study, two ceramic bodies as cordierite and cordierite-mullite were synthesized with calcined spent FCC, waste serpentine, kiln rollers waste and high grade kaolin as raw materials. The XRD results showed that the cordierite and cordierite-mullite were synthesized successfully so that 96.4% of F1 (cordierite) sample fired at 1400°C was cordierite phase and F2 (cordierite-mullite) sample fired at 1450°C was completely cordierite and mullite phases. The synthesized cordierite and cordierite-mullite samples had lower porosity values and coefficient of thermal expansion (CTE) than similar industrial products. The negative CTE value that obtained from the cordierite sample up to 800°C is favorable for some applications. The considerable results of the synthesized cordierite and cordierite-mullite from this work presents cost reduction of the two ceramic bodies production and may help to solve the environmental problems with the use of three waste sources in large scales.

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