MITT.ÖSTERR.MINER.GES. 149 (2004)

CHEMICAL AND MINERALOGICAL CHARACTERIZATION OF SOME RAW CERAMIC MATERIALS AND THEIR TRANSFORMATIONS DURING THE THERMAL TREATMENT

Gorea, M. & Kristaly, F.

Babeş-Bolyai University, Department of Mineralogy (Kogălniceanu Str., 1, 400084, Cluj Napoca, Romania)
e-mail: mgorea@bioge.ubbcluj.ro

Various types of kaoline, feldspar and sand as representative raw materials for electrical ceramics were investigated in order to determine their effect on ceramic properties and microstructure.

The mineralogical composition and structural particular features of the samples of raw materials were tested by X-ray diffraction (XRD), Differential Thermal Analysis (DTA), and Infrared Spectroscopy (IR). The chemical composition of four kaoline samples, a sample of feldspar and one of sand was also determined.

IR spectra present the characteristic bands of raw and thermally treated kaoline; the variations of the intensities in the 3690-3620 cm^{-1} region are related to the crystallization degree (from well- or poorly-crystalline kaolinite). The mullite formation as ceramic phase is strongly influenced by the type or crystallization degree of the clay minerals.

A mixture of these raw materials following the recipe and the specific technology of an usual electroceramic composition was prepared. The thermal treatment of the ceramic mixture and respectively of the raw material was carried out at 1300 °C for 1 hour.

The firing transformations in the mixture and the final microstructure of the ceramics were studied by optical and electron microscopy. The chemical composition of the crystalline and amorphous phases determined by EDX indicated the presence of a certain degree of heterogeneity in the ceramic body's microstructure.

It is concluded that the final microstructure and properties of ceramic products are influenced by chemical and mineralogical composition of the raw materials. Impurities (such as Fe and Ti oxides) have a great influence on the electrical properties. The mineral components, especially those of the kaoline, play an important role during wet preparing of ceramic masses (the presence of smectites increases the plasticity but also the fired shrinkage) and crystalline phase formation during thermal treatment (poorly- or well-crystallized mullite and cristobalite).