Structural and Electrical Properties of Magnesium Oxide- Sodium Silicate Mixtures

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Abstract

In this study, the mechanical and electrical properties of the MgO powder and MgO solved in binder are investigated. For this purpose, the X-ray diffraction, scanning electron microscopy, energy dispersive X-ray analysis and electric field (*E*) -current (*I*) characteristics techniques are employed. Namely, the lattice parameters, the strain and the dislocation density of pure MgO powders and MgO solved in the binder are determined. The effect of MgO content on the electrical conduction is also investigated. The studies revealed that the binder is composed of SiO_2:Na_2O_2:CO_3. The X-ray diffraction patterns which were recorded for a 50% MgO-50 % binder mixture were related to the cubic structured MgO as major phase, the hexagonal structured Na_2O_2 and SiO_2 as minor phases. While both of MgO and Na_2O_2 caused compressing strains in grains of sizes of 50 and 27 nm, respectively, the SiO_2 phase exhibit stretching strain in grains of a size of 21 nm. The solving of the MgO powder in the binder enlarged the grains of MgO from 9 to 50 nm. On the other hand, the $E-J$ variations have shown that the amount of the MgO content in the binder highly shifts the dielectric breakdown limit toward lower values of applied electric field. The critical electric field at which the breakdown takes place reduces from 286 to 14 V/cm as the MgO content is increased from 20% to 99%, respectively.