Temperature Dependence of Dc Conductivity of Kaolinitic and Illitic Clay

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DC conductivities of illitic (IC) and kaolinitic (KC) clays were measured in the temperature range of 20 °C – 1100 °C. During heating several processes take place in IC and KC – the liberation of physically bound water, dehydroxylation and creation of spinel and mullite. These processes were checked by means of thermogravimetry, thermodilatometry and thermoconductometry. At low temperatures (20 – 350 °C), due to the release and decomposition of physically bound water, H+ and OH− ions are dominant charge carriers in IC and KC. The liberation of physically bound water from the clays takes place in 3 steps in IC, and only in 1 step in KC. After completion of liberation of physically bound water, up to the start of dehydroxylation at the temperature of ~450 °C, the DC conductivity is dominated by a transport of Na+ and K+ ions. During dehydroxylation, H+ and OH− ions, which are released from kaolinite and illite lattices, contribute to the DC conductivity. After a completion of the dehydroxylation, the charge carriers are Na+ and K+ ions. At ~950 °C, small peak of DC conductivity indicates the reconstruction of the metakaolinite lattice into the spinel lattice. In IC, influence of the DC conductivity of the glassy phase (~40 wt.% at 950 °C) suppresses a DC conductivity demonstration of the metaillite ® spinel transformation.