Factors influencing the characteristics of porosity of ceramic materials

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Purpose: *synthesis of samples of ceramic membranes using cheap raw materials: kaolin and saponite (Ukrainian origin); study of the effect of different types of carbonates as pore generating agents ($CaCO_3$, NH_4HCO_3, $(NH_4)_2CO_3$) and dry pressing pressure (8 tons, 15 tons) on the structural characteristics of ceramic materials.*

Two series of ceramic membranes were synthesized: KP1, KP2. The composition of the membranes of the ***KP1*** *series had an unchanged basis: (kaolin (65 wt.%), saponite (10 wt.%), sodium silicate (10 wt.%)). Carbonates as pore generating agents were added in the amount of 15 wt.%. The pressing pressure of the samples was used 8 tons. The maximum values of total, open porosity were shown by the sample with 15 wt.% $CaCO_3$ content.*

The composition of the membranes of the ***KP2*** *series: kaolin (60 wt.%), saponite (10 wt.%), sodium silicate (10 wt.%), carbonates of 20 wt.%. The pressing pressure of the samples was used 8 and 15 tons.*

The highest value of total porosity (46.93 %) and open porosity (20.43 %) has a sample of the KP2 series containing 20 wt.% $CaCO_3$ and pressed under a pressure of 8 tons. A sample of a similar composition, which was pressed under a pressure of 15 tons, had a lower value of total porosity.

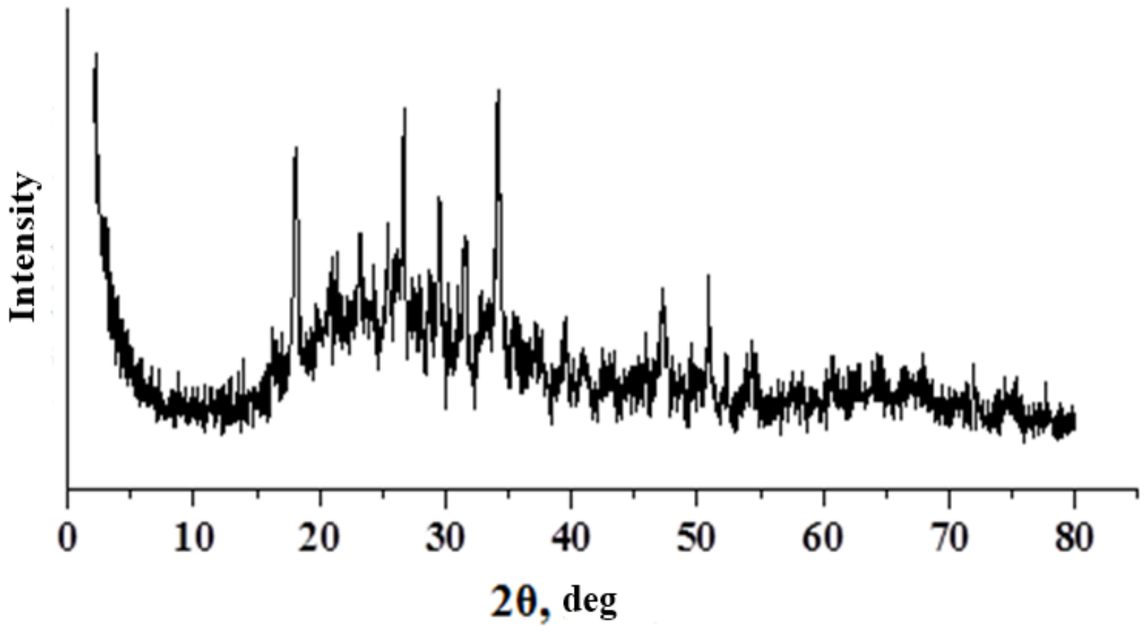

Fig. 1. X-ray pattern of ceramic membrane 20 wt.% CaCO3 and pressed under a pressure of 8 tons

The X-ray pattern (Fig. 1) of the sample shows that the membrane sample is a mixture of kaolinite $Al_4(OH)_8(Si_4O_{10})$ calcium and aluminum silicates $CaAl_{11.77}Si_{2.23}O_8$, with crystallite sizes of − 22 nm.

Research by the method of low-temperature adsorption-desorption of nitrogen on the surface of the sample's porous structure indicates its macroporosity and low specific surface area (4 m^2/g).

Adding silicon carbide to the samples in the amount of 10 wt.% and increasing the content of calcium carbonate to 24 wt.% allows to obtain a sample with better strength, good total porosity (46.11 %) and good open porosity (27.97 %), namely a sample with the following composition: kaolin (46 wt.%), saponite (10 wt.%), sodium silicate (10 wt.%), silicon carbide (10 wt.%), calcium carbonate (24 wt.%).

Conclusions

The best structural characteristics of ceramic membranes samples (total, open porosity) are provided by using calcium carbonate as a pore former in the amount of 24 wt.%.

Lowering the pressing pressure of dry mixtures of ceramic membranes has a positive effect on the formation of greater porosity of samples.