C1-P-024601

MULLITE FILIFORM CRYSTALS PRODUCED BY THE PLASMA MELTING METHOD*

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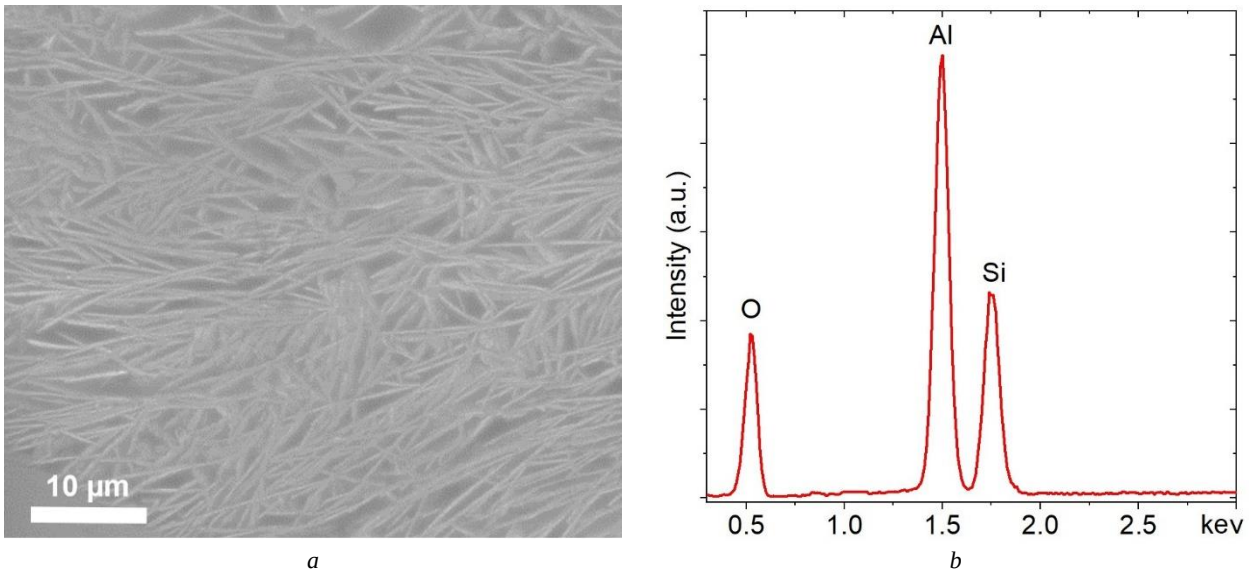
Mullite has excellent heat-resistant and strength properties, which allows it to be widely used in the production of various refractory materials. Mullite is rare in nature, and the main difficulty associated with the synthesis of mullite is the need to use high temperatures to start the process of mullite formation [1–3]. This problem can be solved by arc-discharge plasma, in the flow of which the temperature varies from 1700 K to 18000 K.

In this work, a mixture of aluminum oxide and kaolin from the Zhuravliny Log deposit was used to obtain mullite ceramics. Plasma melting was carried out on an electroplasma stand [4]. The schematic diagram consists of a plasma torch with a remote arc discharge (nozzle diameter 4 mm) installed at a distance of 60 mm from the base of the graphite crucible. Graphite crucible parameters: height 55 mm, diameter 15 mm, wall thickness 3 mm. The melting of the 7 g material took place within 30 seconds at: current strength 100 A, voltage 110 V, plasma gas flow rate 14 nl/min (air). On fig. 1 shows an electron image (*a*) of the surface of the resulting melt product and an EDX spectrum (*b*).



a *b*

Fig.1. Morphology of the surface of the melting product: *a* – TEM images at a magnification of 6000 times; *b* – EDX spectrum.

As can be seen (fig.1, *a*) the surface morphology is represented by branched system of filiform crystals. The filaments are ~1–2 μm in diameter, and their length does not exceed ~40 μm. The formation of weakly anisotropic filaments is carried out according to the vapor-liquid-solid phase mechanism as a result of moderate heat removal. Analysis of the EDX spectrum (Fig. 1, *b*) showed that the condition 3:2 – Al_2O_3:SiO_2 is satisfied, which is typical for the $3Al_2O_32SiO_2$ mullite phase. Thus, the work shows the possibility of obtaining filiform mullite ceramics by plasma melting of natural materials.

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* The work was carried out with the support of the state task of the Ministry of Science and Higher Education of the Russian Federation FEMN–2020–0004 and grant President of the Russian Federation MK–66.2022.4.