ULTRAFINE ALLOYED FORSTERITE POWDERS OBTAINED BY SOL-GEL METHOD

Ya. Vakhula, I. Borshchyshyn, I. Lutsyuk
Lviv Polytechnic National University, Lviv, Ukraine
E-mail: sylikat@polynet.lviv.ua

The modern technical ceramics require the producing of powders with submicron sizes of grains for materials with high operating characteristics obtaining. The Mg_2SiO_4 forsterite powders arouse the significant interest in this case, because this mineral has not polymorphous forms and can stably operate in wide temperature range. If such powders are doped with chromium, then they can be used for producing of transparent ceramics and nanocomposites with transparent matrixes from polymers and glass that can be used in laser engineering.

The alkoxide variant of sol-gel method was used for obtaining of forsterite powders with stoichiometric composition. The preparation ingredients for sol were ethysilicate hydrolyzate and magnesium acetate. The atoms chemical indifference criterion, atoms sizes and interatomic bond nature were considered for alloying elements selection. Cr^{3+}, Y^{3+} and Zr^{4+} ions have been introduced into basic solution of system $MgO\text{-}SiO_2$ through salts $Cr(NO_3)_3 \cdot 9H_2O$, $Y(NO_3)_3 \cdot 6H_2O$ and $ZrOCl_2 \cdot 8H_2O$ (10 mass %). The received gels were drying and annealing at the temperature 900°C for 2 hours.

The X-ray phase, X-ray, IR-spectroscopic analysis of obtained powders were pursued.

Only forsterite was indicated in all powders by X-ray phase analysis. In the powders without alloying additives the periclase MgO (3…4%) is present.

The more intensity of diffraction maximums points to the fact that Cr^{3+} ions introducing permits to receive the monophase product of forsterite with high crystallinity degree. The results of X-ray analysis confirm the isomorphous replacement in forsterite structure on atomic and molecular levels.

The size of powder grains is 40…80 nm.

The physical and electrical characteristics of synthesized powders are determined.