ULTRAFINE SILICON AND GERMANIUM FROM MECHANOCOMPOSITES SI(GE)/MGO AFTER THE SEPARATION OF MAGNESIUM OXIDE

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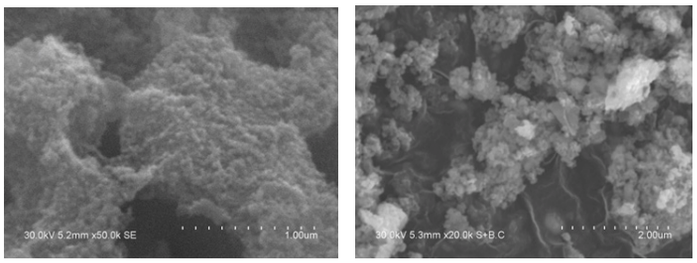
The specific properties of substances in the ultradisperse state open great opportunities for the development and creation of new materials with increased porosity, sensory systems, modified polymeric matrices and etc. [1].

Highly dispersed silicon under standard conditions, it is only able to interact with the strongest oxidant - fluorine. High light-absorbing capacity is several times higher than that of the crystalline form. In the form of powder, it is easy to apply to any surface, whether plastic or glass. Therefore, ultrafine silicon is so convenient for use. This is one of the most sought-after elements in electronics and engineering. The possibilities of its application are expanding every year.

Ultra-disperse germanium powders are used in the coating of optical components, as a doping additive, in the creation of new composite materials, certain germanium alloys (Au-Ge, Cu-Ge, etc.), nanotechnologies, microelectronics, microwave devices, fiber and infrared optics, nuclear physics (gamma-ray detectors), and also for the production of germanium single crystals.

The thermodynamic possibility of reactions of magnesium and oxides silicon and germanium reactions was determined based on literature data. The physico-chemical properties of silicon**,** germanium, magnesium, magnesium oxide (melting points, redox potentials, etc.), which prevent significant sintering of mechanochemical reduction products, make it possible to form a Si(Ge)/MgO mechanocomposites. Magnesium oxide, when reacted with hydrochloric acid, forms a highly soluble compound MgCl2 [2], therefore, it can be extracted quite easily from Si(Ge)/MgO mechanocomposites. Due to the fact that the reduced silicon and germanium does not interact with the solution of dilute hydrochloric acid, with acid treatment of the mechanocomposite, it is possible to separate silicon and germanium from the by-products of mechanochemical reduction.

The effect of the stoichiometric composition and the time of mechanical activation on the composition of the products of mechanochemical reduction of SiO2 or GeO2 by magnesium by X-ray phase analysis were studied. It is shown that the process of mechanochemical reduction is completed by 4 min of activation. The conditions for separating silicon and germanium from mechanocomposites are determined. Electron microscopic analysis showed, that ultra disperse silicon and germanium powders consist of aggregates of primary particles, almost spherical in shape with sizes from 50 to 100 nm (Fig. 1). The energy-dispersive X-ray spectroscopy (EDS) method was used to determine the magnesium content in the obtained of silicon and germanium powders.



a b

Fig. 1. Electron micrographspurified ultradisperse silicon (a) and germanium (b), magnification: a – 50000; b– 20000.

REFERENCES

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