EXPERIMENTAL STUDY OF FORMATION PROCESS OF NANOMEASURED CHRYSOTILE - ASBESTOS UNDER HYDROTHERMAL CONDITIONS

Maslov A.V., Korytkova E.N., Gusarov V.V.
masalex@hotbox.ru
Fax: (812) 351-08-01; Tel.: (812) 328-85-89

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With the help of hydrothermal synthesis the chrysotile asbestos's described nanomeasured by magnitudes of filaments and were obtained greater in comparison with a natural chrysotile - asbestos, structural homogeneity. The structure of an obtained yield is characterised by presence nanotubes such as "the cylinder in the cylinder" and "a cone in a cone" that defines its good surface and getter properties. The opportunity of use for synthesis nanomeasured of a chrysotile - asbestos of cheap natural raw material - widely widespread minerals, breeds and wastage of some productions, adds motivations to conducted operation.

In quality precursors for hydrothermal synthesis were utilised: chemical agents - oxyhydroxide of magnesium, oxide of silicon, silicate of a sodium; a talcum, a enstatit; the components of magnesium as oxyhydroxide of magnesium or magnesia to a talcum and enstatite for making a necessary relation of oxides. The mother compounds exposed by autoclave hydrothermal handling by distilled water and water solutions NaOH at T=200-450°C with a step 50°C and pressures from 30 up to 100 MPa during different time (from 1 about 20 day). The excessive pressure inside a autoclave was created by water vapour. The density of alkaline solutions varied in a gamut from 0.5 up to 7 mass percents. The yields of hydrothermal handling were washed from alkaline builders, were exsiccated and exposed to a complex physicochemical research.

Is established, that on a crystallisation of a filamentary chrysotile - asbestos render influence all parameters of hydrothermal synthesis, but most important are: temperature, time of handling, density NaOH in reactionary medium. By a determinative ensuring deriving monomineral - chrysotile of a yield, the relation MgO:SiO2 appears. The optimum relation of these oxides equal is detected 1.3-1.5. At smaller relations a part of initial phases (the talcum and enstatite) remains invariable, and the quartz is formed of mixture of chemical agents apart from chrysotile. From mixtures with MgO:SiO2 > 1.5 yields of hydrothermal handling is combined mainly by brusite.

Fig. 1. The Cylinder in the cylinder

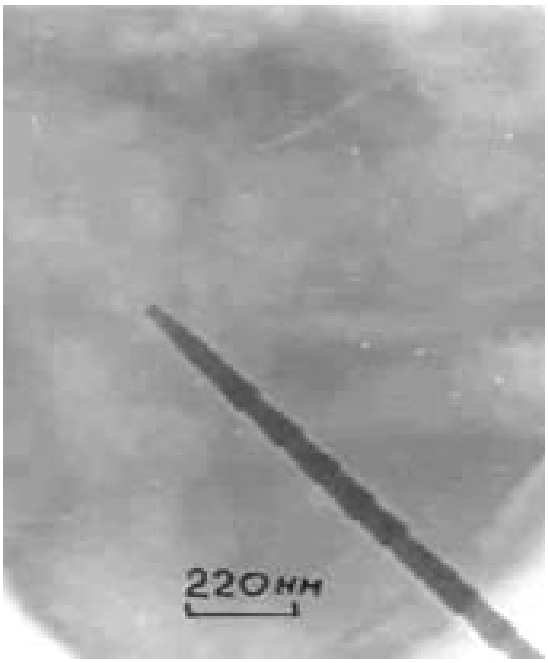

Fig. 2. A cone in a cone

Temperature, as a thermodynamical coordinate, considerably influences character of shaped phases. At an optimum relation MgO:SiO2 in original stocks for synthesis of pure(clean) chrysotile, unblended, are most favorable: temperatures 350-400°C and duration of hydrothermal effect 2 day (for a talcum - 1 day). At 200-300°C the crystallisation of chrysotile goes slowly, demanding long-lived, about 20 day, hydrothermal handling of original stocks by alkali solutions NaOH, and the part of initial minerals is saved invariable. At high temperatures, is higher 400°C, in yields of synthesis, apart from chrysotile, occur forsterite, Na-mica (in case of an initial talcum), richterite. Velocity and degree of chrisotilisation process appreciably depend and on character of reactionary medium: at hydrothermal handling of original stocks the distilled water requires a major duration, and in a yield there is a part of a unreacted material. The reactionary mediums with density NaOH 1-1.5 masses % are most favourable.

The electronic - microscopic research determines a tubular structure of filaments of an obtained yield described by a wide variety of the morphological shapes: “ the cylinder in the cylinder ” (fig. 1) and “ a cone in a cone ” (fig. 2), and also as "muff". The external diameter of inoperable chips of chrysotile is nonconstant: at cone-shaped of chips it oscillates from 20 up to 50 nanometers, and the chips “ the cylinder in the cylinder ” are characterised by a variable (from 20 up to 80 nanometers) external diameter and parallel arrangement of surfaces. The greatest amount of filaments with abnormal morphology is characteristic for chrysotiles synthesised in water and to a lesser degree in alkalescent solutions. The presence of imperfections of a structure at obtained nanotube of chrysotiles can negatively have an effect on operating performances of materials on their basis. In this connection the special attention in operation was given to detection of area of formation undefects nanotubes of chrysotile.

In result the optimum requirements of deriving structurally of homogeneous chips of chrysotile, as thin tubes without anomalies and imperfections with a constant of external diameter equal 25 nanometers were established. Those are: initial suspensions on the basis of a talcum and enstatite at a relation MgO:SiO2=1.3, temperature 350-400°C and density NaOH in reactionary medium from 1 up to 1.5 percents(interests).

In summary, it would be desirable to pay attention to ample opportunities of application nanotubes of mineral substances, for example in quality of nanoreactors.