

SYNTHESIS OF INORGANIC POROUS MEMBRANE BY SOL-GEL PROCESS AND CHARACTERIZATION

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Abstract

Until these last years, the industrial membranes used for filtration, distillation, separation or extraction were manufactured from polymers. However, these present a bad chemical thermic and mechanical resistance which limit their life time. To eliminate this problem, the development of membranary technologies had introduced the membrane mineral which are prepared form ceramic materials, they offer many potential advantageous for separation processes. These features have attracted a great deal of attention from the standpoint of membrane applications.

Among the methods of preparation developed, the sol-gel process is the way to obtain an inorganic structure which will become a porous layer with controlable porosity.

Solution chemistry in which weak interactions favor the self assembly of molecular precursors opens many possibilities for the synthesis of oxide materials. The state of the final products strongly depends on the sol-gel and drying conditions in which it is prepared. It is therefore of importance to determine how sol-gel parameters affect the physical properties of membrane.

The synthesis of gel is based on hydrolysis-condensation reactions indirectly to form a veritable lattice of oxide from molecular precursors. The hydrolysis reaction must be controlled to avoid precipitation of hydrous metal oxide. A true oxide network is formed by chemical bonds in the solution. Condensation reactions can then be controlled giving monodispersed oxide nanoparticles. The control of sol-gel transition and thermal decomposition has allowed us the synthesis of the mixed oxide $Al_2O_3-SiO_2$

The deposit thin layers has been realized with a sol prepared with the destabilization of colloidal solutions process. This is possible by infiltrating a low viscosity sol or by direct coating on to an ultrafiltration layer. We have choosen to study the $Al_2O_3-SiO_2$ system for their interesting properties and the interest which may bring in the domain of inorganic membranes chemical and mechanical high resistance.

These results show the great potentiality of inorganic membrane and allow new applications to be taken into account, particulary waste water treatment, gas separation. The structural characterisation was studied by differential thermal analysis, infrared spectroscopy, X-ray diffraction, and the textural characterization by nitrogen adsorption-desorption allowed us to observe the variation of the surface area, porous volume and pore diameters according to temperature. The obtained results by adsorption-desorption of nitrogen showed that textural characteristics are linked at structural changes.

Scanning electron-spectroscopy observation showed homogeneous layers without cracking. In this paper, some experimental results on the synthesis and characterization of inorganic membrane will be presented.

Keywords : sol-gel , membrane , porous

