

CHEMISTRY OF SURFACE AND THIN FILMS

The ways of the obtaining of antibacterial composite films

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The purpose of the investigation was the search and practical realisation of the simple and effective ways of different materials protection from biopollution under exploitation. Especially it concerns silica-alumina ceramics used in manufacturing of filters for liquids sterilization cleaning.

In this work the possibility was found to impart prolonged antibacterial properties to the silica-alumina ceramics by the formation on its surface of silver containing composition films 150–200 nm in thickness by the method of hydrolytic decomposition of the substances included into the impregnating solutions.

The solutions used for deposition of silver containing films represented poorly coagulating sols which were prepared by mixing of isopropil solutions containing silver nitrate and easily hydrolyzing compounds of titanium, titanium and tin, titanium and aluminium, titanium and silicon. Antibacterial films thus obtained included the amorphous products of oxo- and hydroxo compounds of these metals and AgCl nanoparticles 100–150 nm in size which were responsible for biocide action.

Antibacterial properties of the films were analyzed by the conventional diffusion method against Gram-positive and Gram-negative bacteria. The results of the experiments were evaluated by analyzing the width of the inhibition zones of bacteria growth around the ceramic samples coated with antibacterial coating. Diameters of these zones varied from 2 to 15 mm showing the availability of the biocide effect. The largest zones appear in case of the samples containing the products of titanium and tin compounds hydrolysis. The zones were absent in case of the samples containing silver nanoparticles obtained by the treatment in the alkaline formaldehyde solution. Nevertheless, transformation of Ag nanoparticles into AgCl ceeds by treatment in NaCl – H₂O₂ provided the appearance of zones and the rise of biocide activity. The reasons of distinctions in antibacterial properties of silver and silver chloride are discussed in the report.