

## SECTION 2 SYNTHESIS OF NEW CHEMICAL MATERIALS AND THEIR APPLICATION

### SYNTHESIS OF Ag AND Au NANOPARTICLES IN PORES OF ANODIZED ALUMINA

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Synthesis of porous alumina was carried out under "rigid" conditions of anodizing in the solution of oxalic acid. Anodizing of aluminum was carried out in a two-electrode electrochemical cell. The resulting alumina matrix was separated from the unreacted aluminum by selective dissolution of the latter in a solution of  $\text{CuCl}_2$  in HCl. Expansion of pores was carried out in orthophosphoric acid at a temperature of 600 °C for 5-10 minutes. After expansion of the pores, Ag and Au nanoparticles were introduced into the pores of aluminum oxide.

Solutions of  $\text{HAuCl}_4$  and NaOH were prepared. To prepare a solution of  $\text{HAuCl}_4$  with a weak concentration of 1 ml of Au working solution, 9 ml of deionized water is added. The pH of the  $\text{HAuCl}_4$  solution was added dropwise by addition of a solution of NaOH (1N), to pH = 1.5-1.95.

Then, an anodized aluminum oxide film is immersed in a solution of  $\text{HAuCl}_4$  (pH = 10) and heated at 80 °C for 2 hours. At the end of time, the color of the film changes from white to crimson pink. This is a sign that gold nanoparticles formed on the pores.

Synthesis of silver nanoparticles in porous alumina was carried out by the method of controlled single-jet crystallization. The method is based on the reduction of the ammoniacal complex of the silver by a reducing agent. The reducing agent was used formic acid. An aqueous 0.4% silver solution was prepared with addition NaOH to the solution.

After the formation of silver precipitates at the bottom of the glass, the top of the solution was gently poured off and the glass washed 2-3 times with distilled water. To the pellet was added 5 ml of deionized water. 400  $\mu\text{l}$  of a concentrated aqueous ammonia solution was added to the resulting solution. A film of aluminum oxide preliminarily heated to  $T = 80$  °C was dropped into the solution and 400  $\mu\text{l}$  of formic acid was added. The reaction takes for 4-5 minutes. After that the alumina film is taken out from the solution and washed with distilled water. At the end of time, the color of the film changes. This is a attribute that silver nanoparticles formed in the pores.