

Effect of Pd/Au Catalysts on Surface Morphology of Electroless Plating

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Recently, the plating for forming the micro pattern onto the remarkably flat surface is required. At the smooth surface, the improvement in the adhesion of a plating film according to the anchor effect cannot be desired. The method for forming the plating film of which the adhesion is high at the smooth surface is required without etching.

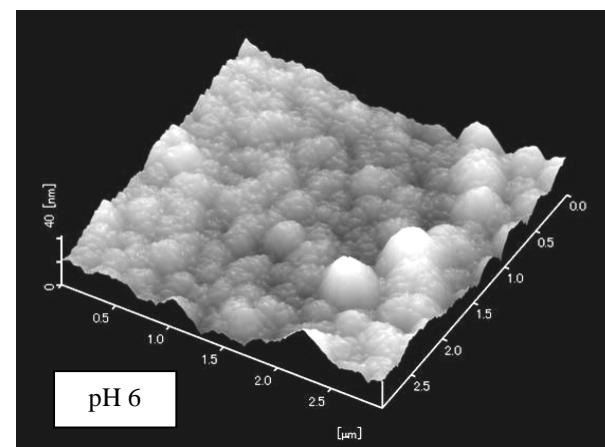
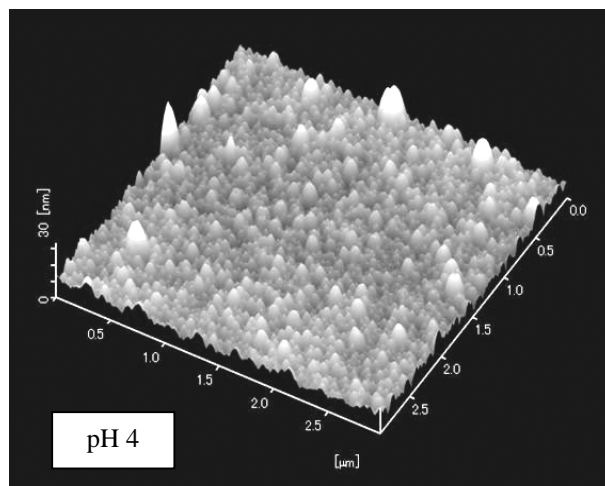
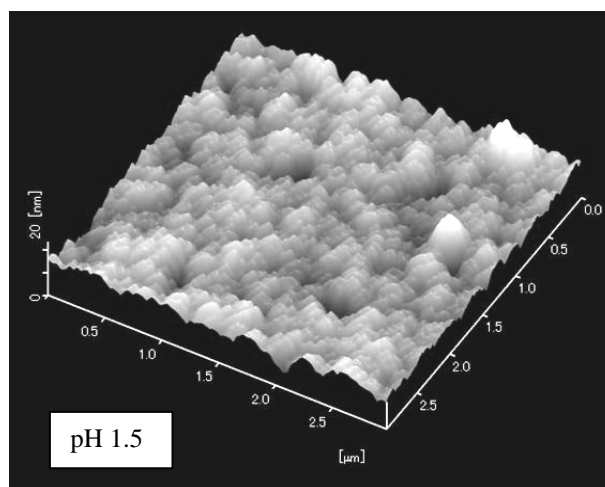
It was found that adherence strength of the plating film was remarkably improved on smooth sapphire substrates modified with coupling agent and Pd/Au mixed catalysts.

The purpose of this study is to examine the relationship between condition of catalyst solution and the surface morphology of electroless plating.

Sapphire substrates (99.99% Al_2O_3 , 30mm diameter, $R_a = 0.13$ nm) were used. The γ -aminopropyl ethoxy silane was used for the silane solution. The catalyst aqueous solutions containing 5×10^{-4} M Pd ions and 5×10^{-4} M Au ions were prepared at various pH values (1.5, 3.0, 4.0, 5.0, 6.0). The electroless Ni-P plating bath (0.1 mol/dm^3 $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$, 0.2 mol/dm^3 $\text{NaPH}_2\text{O}_2 \cdot \text{H}_2\text{O}$, 0.2 mol/dm^3 $\text{H}_2\text{NCH}_2\text{COOH}$, pH 5.0) was used at 343 K. The sapphire substrate was dipped in the silane solution and dried in drying oven. The modified sapphire substrate was dipped in various catalyst solutions, and then dipped in the plating bath. The plating thickness was about 1000 nm after the plating for 12.5 min. The surface was observed with DFM (AFM using tapping mode).

DFM observation of the plating films, which were deposited on the sapphire substrates prepared in catalyst solution with various pH, was carried out. The height of plating particles was about 9 nm, when the catalyst was prepared at pH 4. On the other hand, there were plating particles being >30 nm high, when the catalyst was prepared at pH 6. The surface roughness of plating is minimum value, when the catalyst was prepared at pH 4.

The relationship between pH of Pd/Au mixed catalyst solutions and surface roughness (RMS) of electroless plating film was examined. The roughness (RMS) of the electroless plating film was the smallest under the condition of pH 4.



Figs. DFM images of electroless plating on sapphire substrates modified in various pH of catalyst solutions.