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Au/Ag nanostructures on PMMA surface

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Abstract – Nanoholes distributed in PMMA surfaces were obtained, as well as nanostructures of Au or of Ag on these films. The PMMA films were prepared by dilution in chloroform and spin-coating at 3500 rpm rotation speed for a time of 10 s in environment conditions. Conform to AFM, the diameter and depth of the nanoholes formed on the films had presented values around 200 nm and 12 nm, respectively. These films were used as templates in self-assembly process of metallic nanoparticles. The metal deposited on polimeric surface showed a tendency the agglomerate in the nanoholes edges, due to difference in the surface energy between metal and polymer, enabling the formation of metal nanostructures on PMMA.

The investigation and obtaining of nanostructured systems is an area of great scientific and technological interest at the present time, because technical applications exist in many different fields as materials science, biomedical science, electronics, optics, magnetism, and electrochemistry [1]. There are a great variety of techniques today capable to create nanostructures with several degrees of quality, speed and cost. The self-assembly is a bottom-up process of production where groups of molecules or particles are manipulated through natural processes [2,3]. An enormous economic and environmental interest exists in the success of this process type, due the possibility of production in large scale of nanostructures and new materials, what is obtained difficultly by other routes. In this work, nanoholes distributed in PMMA films had been manufactured and analyzed, as well as the behavior of metallic particles deposited on the films. The thin films had been prepared by spin-coating in 3500 rpm rotation speed for a time of 10 s in environment conditions. The topography of the PMMA films was characterized by atomic force microscopy, indicating the nanoholes formation (fig.1). The measured diameter and depth of the nanoholes formed on the films presented values around 200 nm and 12 nm, respectively. We verify that the films are favorable for use as templates in self-assembly process. An analysis of the organization of silver and gold nanoparticles deposited on the films showed a tendency at agglomeration in the nanoholes edges on the polymeric film surface (fig.2), due to difference in the surface energy between metal and polymer, enabling the formation of metal nanostructures on PMMA, in accordance with the growth mode Volmer-Weber [4]. The atoms of Au and Ag self-organized during the deposition by diffusion of atoms on the edges of nanoholes forming small rings, to minimize the energy of the system.

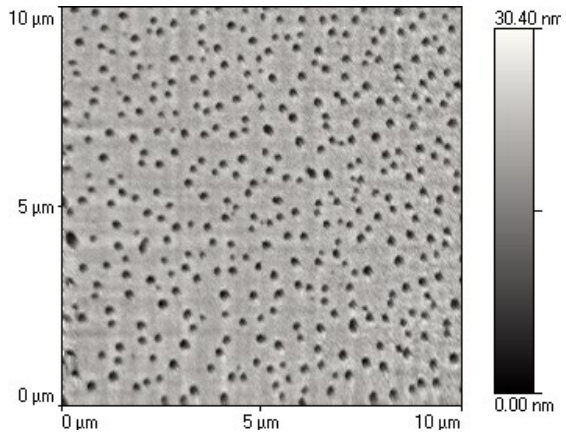

Figure 1: AFM images of sample with concentration of 4 mg/ml of PMMA prepared at 3500 rpm.

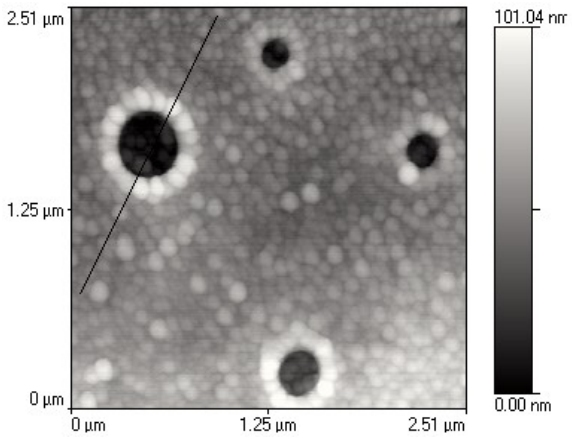

Figure 2: AFM images of sample with Ag deposition on PMMA surface.

References

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