Thin oxide layer formation for optically active coatings

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Nanoporous anodized aluminum oxide (AAO) membranes are widely used as templates for creation of nanostructures. In this work, nanoporous AAO layer on aluminium surface was used as a mask for optically active coating formation. AAO membranes were prepared on aluminum surface using two-step anodizing process (Fig. 1A). AAO pore parameters, diameter, separation and ordering can be controlled by varying electrolyte type, anodization time and voltage, to obtain optimal oxide layer thickness of 60 - 280 nm, with pore diameters 16 - 40 nm [1, 2]. Normally, thin layers of AAO do not exhibit optical activity in the visible spectrum. This can be radically changed by deposition of thin metal layer on the AAO surface (Fig. 1B), which forms a thin metallic layer with nano-holes and nano-particles embedded in the oxide layer. Apart from interference effects between reflections at different layer interfaces, such structures also support propagating and local surface plasmon modes. For Au and Ag the plasmonic resonances can occur in the visible and near infrared spectral range. The coating properties can be tuned by variation the AAO layer thickness, hole diameter, hole density and metal layer thickness. We present a systematic study of these multilayer systems and demonstrate their application for sensor devices.

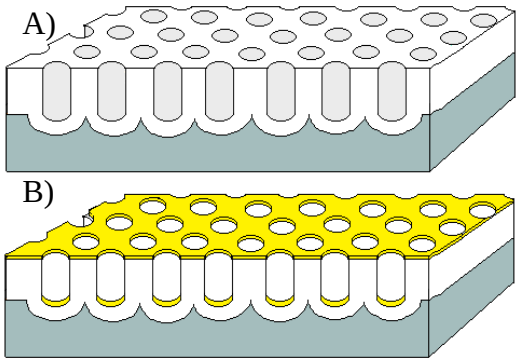

Fig.1 A) AAO coating obtained in anodizing process; B) Formed thin metal film with nano holes and nanoparticle arrays

The work was done within ESF project 2013/0028/1DP/1.1.1.2.0/13/APIA/VIAA/054.

References:

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