Surface-induced self-organization of phenyl silsesquioxane thin film as a template for metal/oxide nanostructures growth

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The template-assisted (TA) growth of nanostructured thin films comprises various techniques, including both bottom-up and top-down approaches. The most used techniques involve a multi-stage process that begins with template fabrication and ends with several steps of nanostructure fabrication. We propose a simplified approach to TA growth by utilizing cage silsesquioxane self-organization as a new form of a template, reducing the process into two *in-situ* steps.

Our research highlights the ability of self-organized phenyl silsesquioxane (PSS) thin films to selectively evaporate, as revealed by our experimental findings. By controlling the time and temperature of annealing, we can regulate the degree of surface coverage with PSS nanostructures. These nanostructures can serve as a template for depositing a metallic layer. By raising the temperature above the total sublimation of the PSS temperature, a metallic "negative" can be obtained (see Fig. 1). We also explored the possibility of using PSS thin films as a substrate for the growth of oxide nanostructures. The main goal is to achieve metallic or oxide nanostructures that mimic the "moth-eye" structures as an antireflective or hydrophobic layer.

Our studies involve the PVD thin film growth technique in UHV conditions and *ex-situ* structural measurements, including AFM, SEM, XRR, and Raman spectroscopy.

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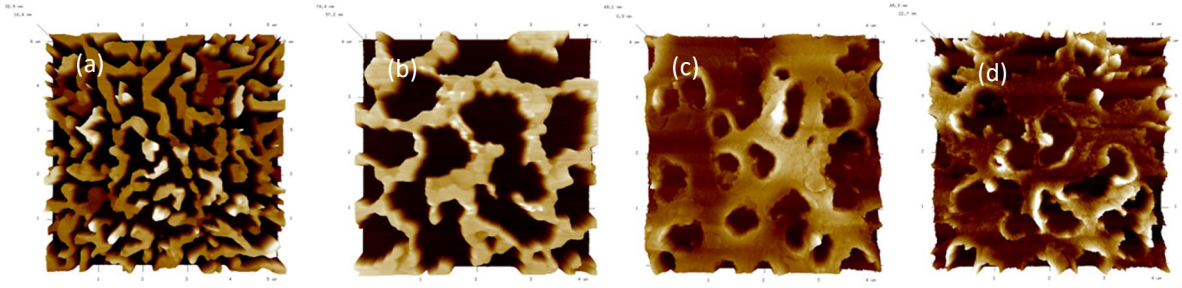

Fig.1 AFM micrographs (4x4 μm^2): (a) and (b) PSS thin films subjected to annealing at different temperatures (difference of 10°C) for 3 hours; (c) and (d) similarly prepared PSS nanostructures, covered with a 5 nm Au layer and heated to a temperature exceeding the PSS sublimation temperature.