**Etch-free method to prepare nanoporous metal layers using directed self-assembly**

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**Abstract**

The self-assembly of block copolymers (BCPs) as thin films on substrates is a simple and cost-effective method to obtain high density arrays of lines or dots with lateral dimensions below 20 nm and it is compatible with standard lithography techniques.[1, 2] The directed self-assembly of the BCPs can provide extensive control of the level of order of the nanostructures arrays[3] but also on their orientation and alignment.[4] Such characteristics make the directed self-assembly (DSA) of BCPs a valuable methodology for cost-effective nanofabrication compatible with the semiconductor industry.[5] Being synthetically tuneable molecules, block copolymers can be modified with functional groups selectively, i.e., functionalise one of the polymer block backbone, to interact specifically with particles or dyes. Then, upon DSA, the particles or dyes are confined to one of the phases.[6] Recently, the incorporation of inorganic or metal nanoparticles with BCPs led to an increased chemical contrast needed, e.g., to improve the lithographic yield of the BCPs systems.[2] Nevertheless, this application usually requires the selective removal of one of the blocks of the BCP.

In the present work, aluminium and chromium nanoporous layers were fabricated by metal evaporation on the block copolymer *poly(styrene-b-ethylene oxide)* thin film. It was observed that aluminium and chromium atoms deposit selectively on the PS block of the BCP surface, thus the latter acted as scaffold surface without the need of an etch step. The chosen polymer templates have three different molecular weights to reach different lateral dimensions and permitted the fabrication of periodic nanopores hexagonal arrays with a pitch ranging from 40 nm to 150 nm and pore diameters of 18 to 90 nm, respectively. The metal layers were fabricated in polymer templates supported in quartz substrates, to study the effect of the metal nanostructuration on the optical properties, and silicon substrates for lithographic applications.

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**Figures**

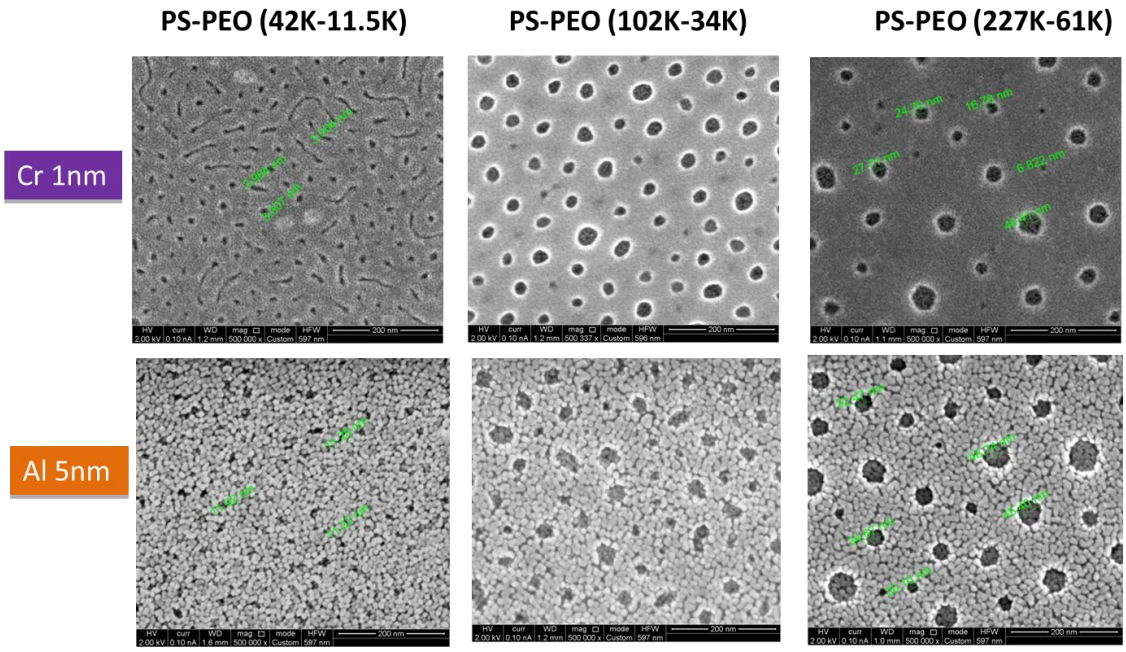


**Figure 1. SEM images of nanoporous aluminium and chromium layers template by three different PS-b-PEO molecular weights.**

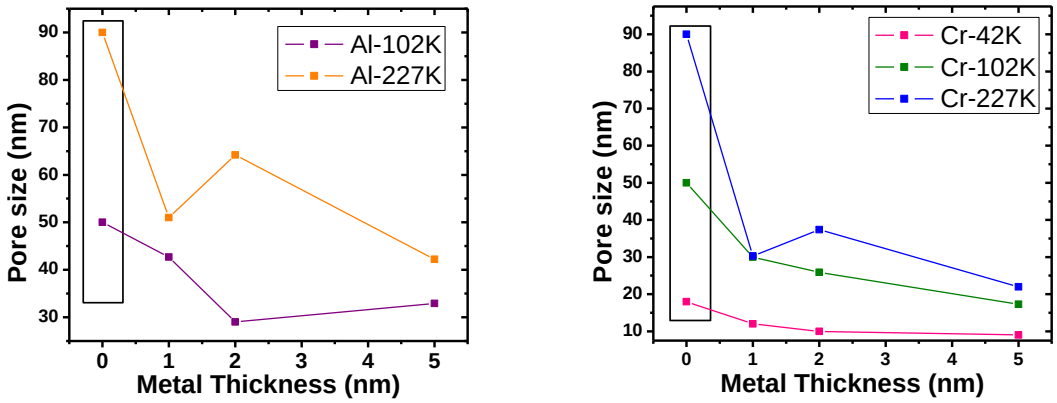


**Figure 2. Dependence of the nanoporous lateral size on the nominal Al and Cr layer thickness templated by different PS-b-PEO molecular weights.**