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Changes associated to ceramic oxides surface modification of a nanoporous alumina membrane by ALD technique

Atomic layer deposition (ALD) technique has demonstrated to be an adequate procedure for geometrical and surface modifications of nanoporous membranes with well-defined morphology (parallel array of straight nano-channels without practically pore radii dispersion) obtained from polymeric (polycarbonate track etched procedure) and ceramic (two-step aluminium anodization method) membranes [1-2]. Moreover, the election of the deposited material can open the common field of application of these membranes (drug delivery and microfluidics) to optical and electro-catalytic devices.

This work presents geometrical, chemical, electrochemical and optical characterizations of nanoporous structures (NPSs) obtained by deposition of different metal (Ti, Fe, Si,..) oxides by ADL technique on a nanoporous alumina membrane (NPAM) with the following geometry: average pore radii of 12 nm, porosity of 12 % and 63 μm in thickness (Fig. 1 left). NPSs have been characterized by X-ray photoelectron spectroscopy (XPS) and scanning electron microscopy (SEM) imagine analysis to establish the presence of the coating material on the alumina surfaces (external and pore walls) and its effect on NPAM morphology (Fig. 1 right). Optical characterization of both NPAM and NPSs was performed by UV-Vis-NIR spectroscopy measurements (wavelength between 200 nm and 1000 nm), which give information on samples behaviour in the visible and near-ultraviolet regions. Diffusive ionic transport was also considered by analyzing concentration potential measurements performed with NaCl solutions [3]. This set of measurements allows a rather complete picture of NPSs characteristics, which permits the election of the most adequate ceramic oxide coating material depending on NPS application.

References

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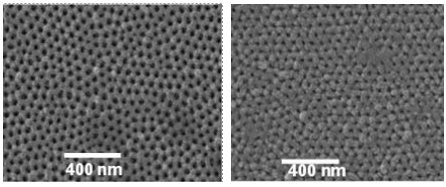

Figure 1: SEM top view images of: NPAMs (left); NPAM+SiO_2 (or NPS) (right).