Anodization of porous anodic alumina oxide membranes with phosphonic acid

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Self-ordered porous anodic aluminum oxide (AAO) membranes are typically prepared using the traditional self-ordering regimes reported by Masuda et al. For this purpose, aqueous solutions of sulfuric acid (interpore distance ~50 nm), oxalic acid (interpore distance ~100 nm) and phosphoric acid (interpore distance ~500 nm) are used as electrolyte solutions [1]. The production of large-pore AAO using phosphoric acid at high anodization voltages is associated with high scrap rates because of the occurrence of burn events during anodization [2]. To date, to the best of our knowledge, only two studies investigated phosphonic acid anodization yielding self-ordered AAO with interpore distances just above 300 nm, Akiya et.al. [3] and Gordeeva et. al. [4]. Because the self-ordering voltage is lower than in phosphoric acid, the likelihood of burning during the anodization is reduced. This study explores the application of phosphonic acid as an electrolyte for the preparation of self-ordered AAO. The AAO membranes were anodized with 2 M or 1 M phosphonic acid at 273 K with varying voltages (Figure 1). The resulting AAO membranes had interpore distances between 300 and 400 nm (Figure 2), although the uniformity of the pore sizes decreased with the anodization voltage. The dependence of the pore uniformity and ordering on the anodization conditions was also studied, as well as the differences in the growth rates.

References

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Figures

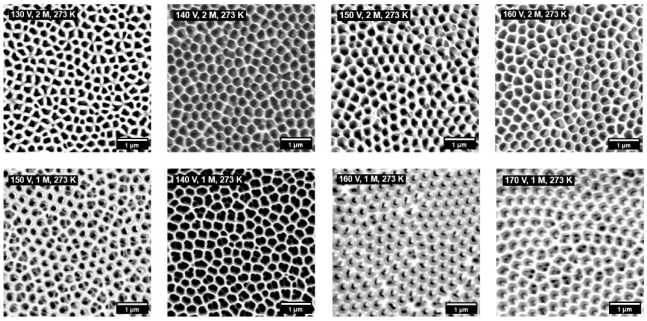

Figure 1: SEM images of the AAO membranes surface fabricated via phosphonic acid with different conditions.

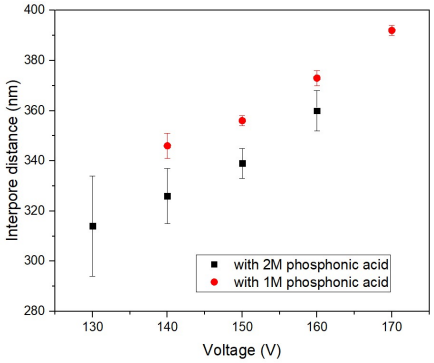

Figure 2: Mean interpore distances of the AAO membranes obtained from the SEM images