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Supplementary information

Plasmonic platform based on nanoporous alumina membranes: order control via self-assembly

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- Fourier and Hough Transformations to Assess the Ordering of Nanochannels in Membranes
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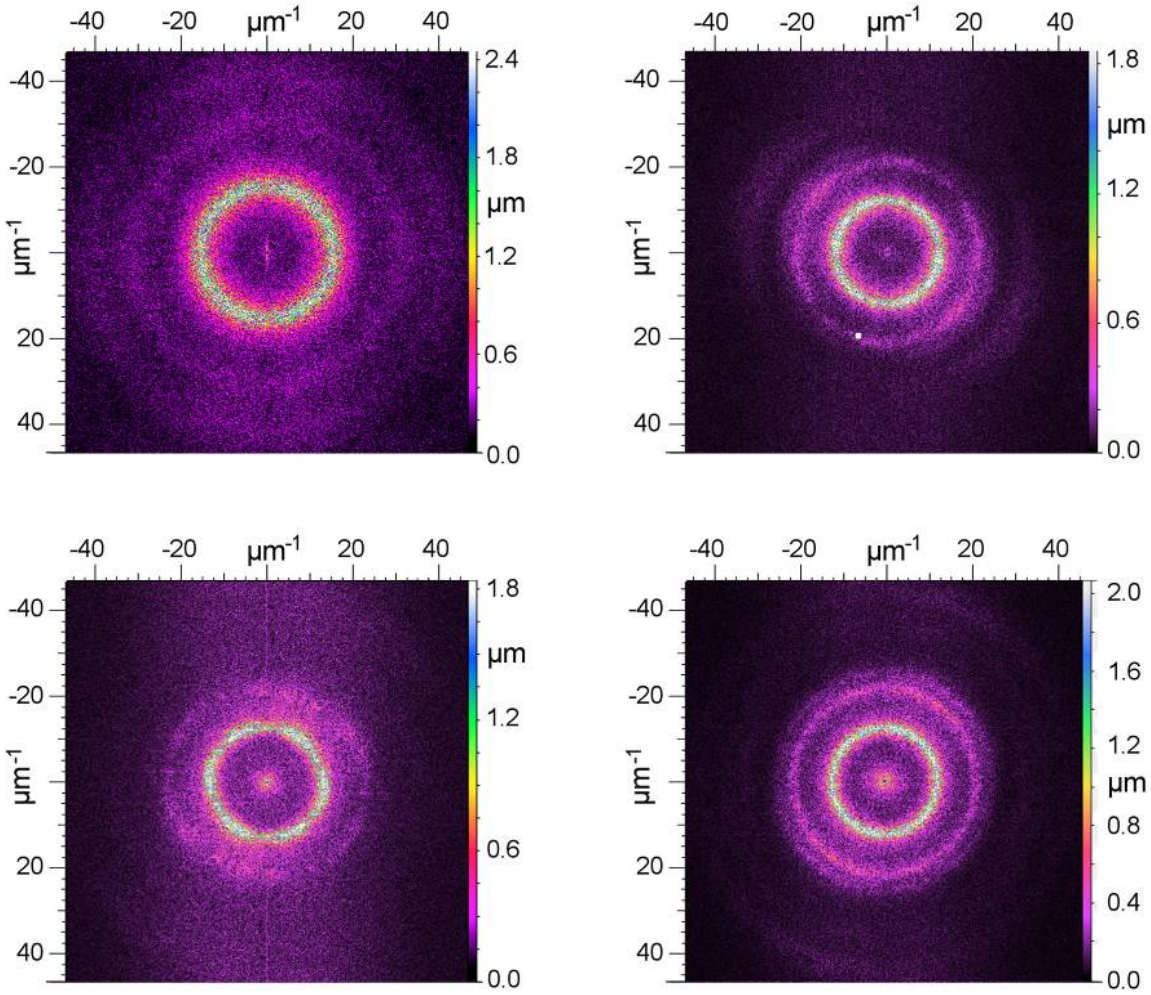

Figure S1. Two-dimensional Fourier Transform (2D FFT) of all selected samples (sample A – 30 V, no annealing, uniform anodization; sample B – 40 V, slow annealing, uniform anodization; sample C – 40 V, no annealing, uniform anodization; sample D – 40 V, slow annealing, non-uniform anodization) generated using the SEM images. Quite noticeable difference in the structure and sharpness of the spectra reflects the ordering of nanochannels.

Fourier and Hough Transformations to Assess the Ordering of Nanochannels in Membranes

Fourier and Hough transformations were used to better assess both short- and long-range ordering in the fabricated and selected samples, aiming to verify the high quality of the produced nanoporous membranes, and to test these assessment methods for specific membrane ordering applications. For this purpose, we have inverted the SEM images of the selected samples, and generated the 2D FFT (two-dimensional Fourier Transform) and Hough patterns.

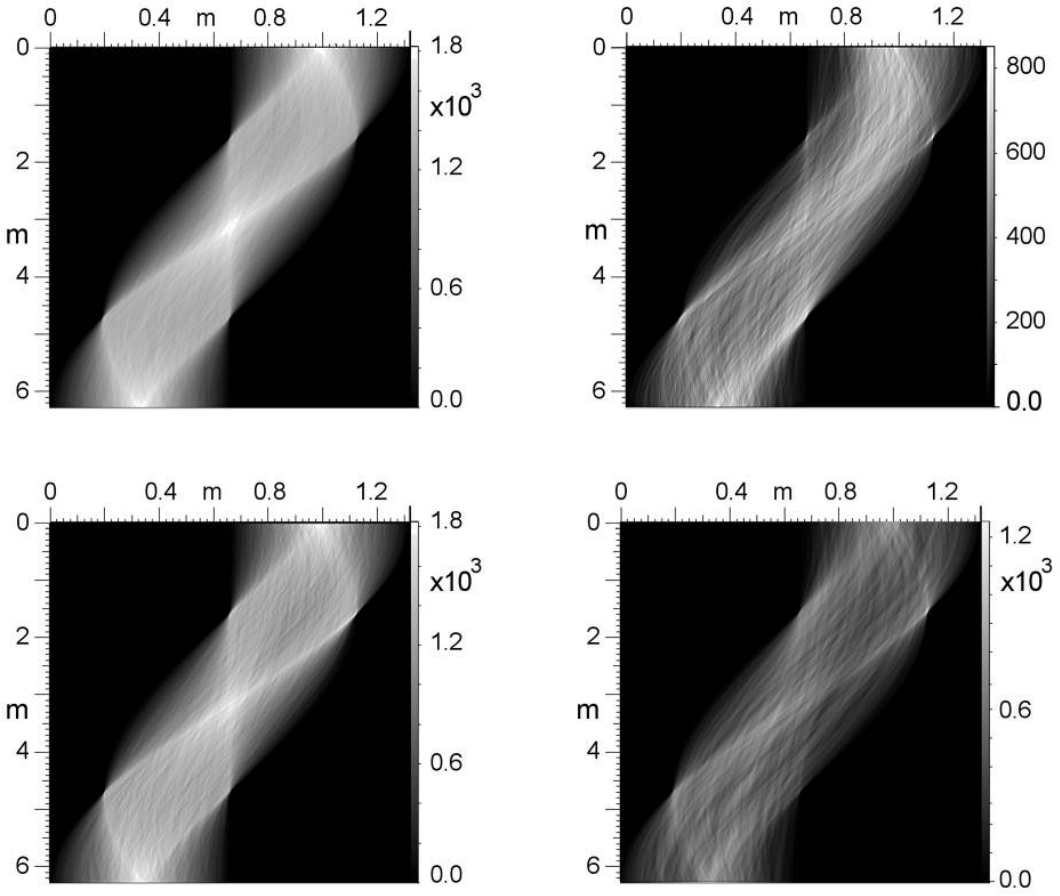

Figure S2. Hough transformation for the four samples A, B, C, and D. Quite different spectra can be observed for samples B and D, as compared with A and C.

Fourier Transformations to Assess the Ordering of Nanochannels in Membranes

The resultant 2D FFT spectra are shown in Fig. S1. The two-dimensional Fourier Transform spectra of all selected samples (we recall here that sample A was fabricated under 30 V, no annealing, uniform anodization conditions; sample B – 40 V, slow annealing, uniform anodization; sample C – 40 V, no annealing, uniform anodization; and sample D – 40 V, slow annealing, non-uniform anodization conditions) were generated using the above described SEM images. From this figure one can notice that the structure and sharpness of the sample spectra are quite different, and thus this method also characterize the ordering of nanochannels. The presence of randomly distributed narrow nanochannels in samples C and D is revealed by the specific shape of the spectra demonstrates more features at the center.

Hough Transformations to Assess the Ordering of Nanochannels in Membranes

Another method for the ordering estimation is the Hough transformation which is being used to search for certain shapes in the pattern. In our case, apparent difference can be noticed in the spectra shown in Fig. S2 for all four samples. We suppose here that these differences could indicate the ordering in the nanochannel patterns, since the perfect hexagonal structure of the defect-free pseudo-crystal features many linearly ordered channels. Sample D appears to be the worse one in respect to the long-scale ordering of the nanochannel.