Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Rhodamine-Doped Nanoporous Polymer Films as High-Performance Anti-Reflection Coatings and Optical Filters

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Indentation of Subsurface Imaging Experiments

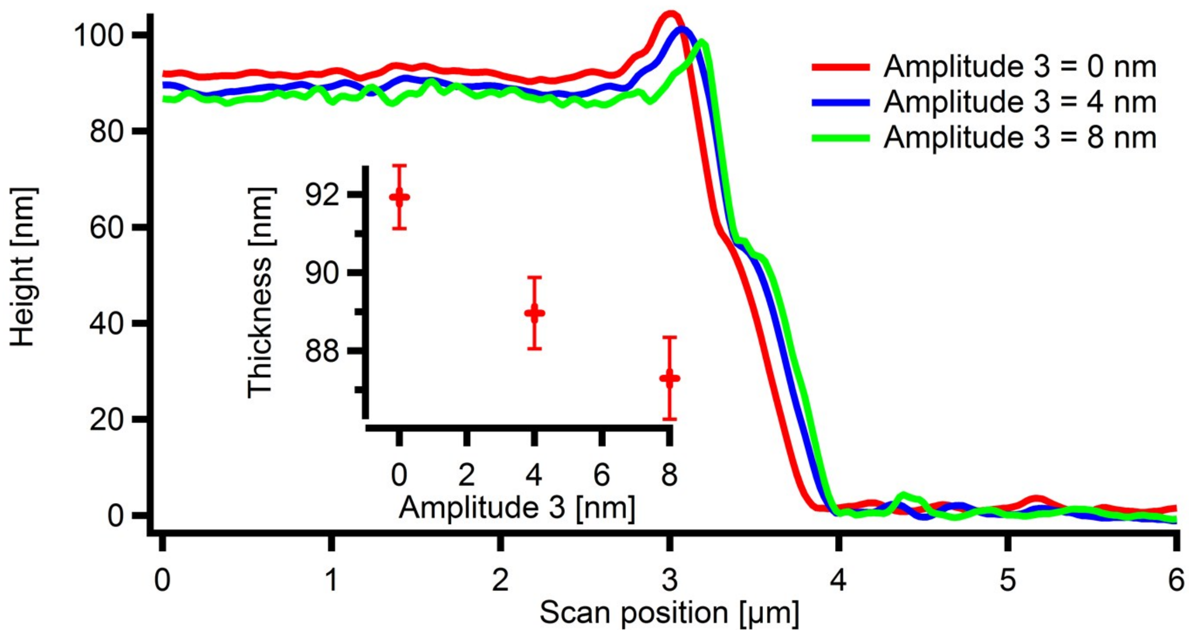

Figure S1: *AFM scan lines of the nanoporous PMMA film edge near a scratch for different 3rd eigenmode amplitudes. The inset shows the average film thickness for the three different modulation amplitudes.*

Internal Porosity of the Films

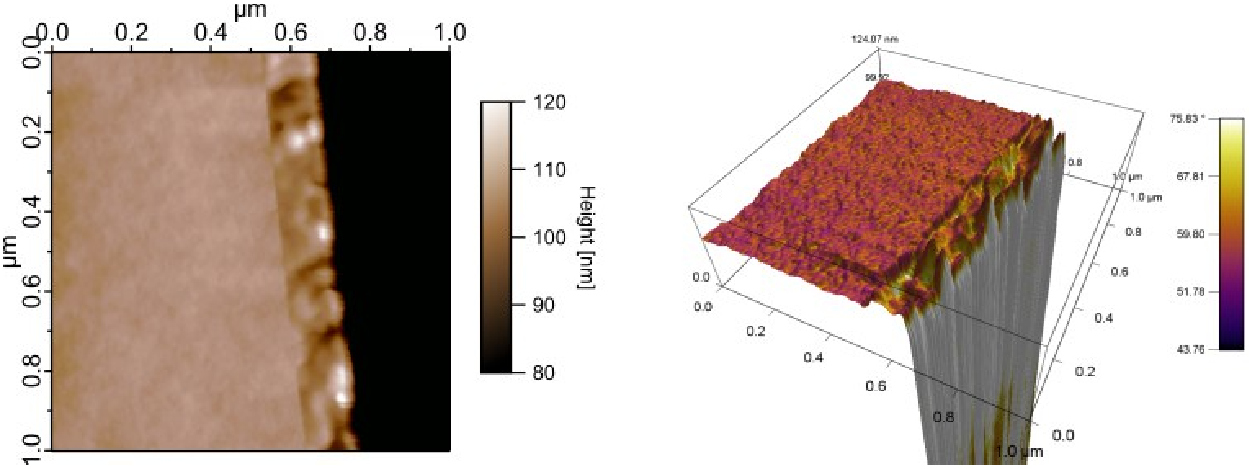

Figure S2: *(Left) Representative topography AFM image of a cross-section of a nanoporous film cracked on its glass substrate in liquid nitrogen. (Right) 3-dimensional topographical image colored with the phase contrast. The glass substrate is located on the left side of the image (away from the color scale bar), while the exposed surface is on the right side. The polymer film is porous not only on its exposed surface but all the way down to the substrate.*

The internal porosity of the films is key to the antireflective properties of the films. Besides the inspection of the top layer and the shallow subsurface with AFM (Figure 3), we froze and cracked five sample films (one using THF as a solvent and one for each combination of THF plus acid/base as a solvent) on their glass substrate in liquid nitrogen and imaged the cross-sections with AFM on 5 different locations for each, with a scan size of 1 μm x 1 μm. A representative image of these cross-sections is provided in Figure S2. The glass substrate is located on the left side of the image (away from the color scale bar), while the exposed surface is on the right side. The polymer film is porous not only on its exposed surface but all the way down to the substrate. In a second verification step, we first measured the film thickness along a scratch in the film before heating the sample above the polymer's glass transition temperature with a reduced pressure of –25 mm Hg (with respect to atmospheric pressure) under a nitrogen atmosphere. This removed the air trapped inside the pores of the PMMA, causing the foam-like structures to collapse. Afterwards, we measured the thickness of the film along the same scratch again (verifying that the film did not run over the scratch or spread), and observed a reduction in height of approximately 70%, which is consistent with the preparation process of the sample and the mixing ratio of PMMA and PS of 30:70. The reduction in height can therefore be attributed to the removal of the air cavities. Representative results of this verification are summarized in Figure S3.

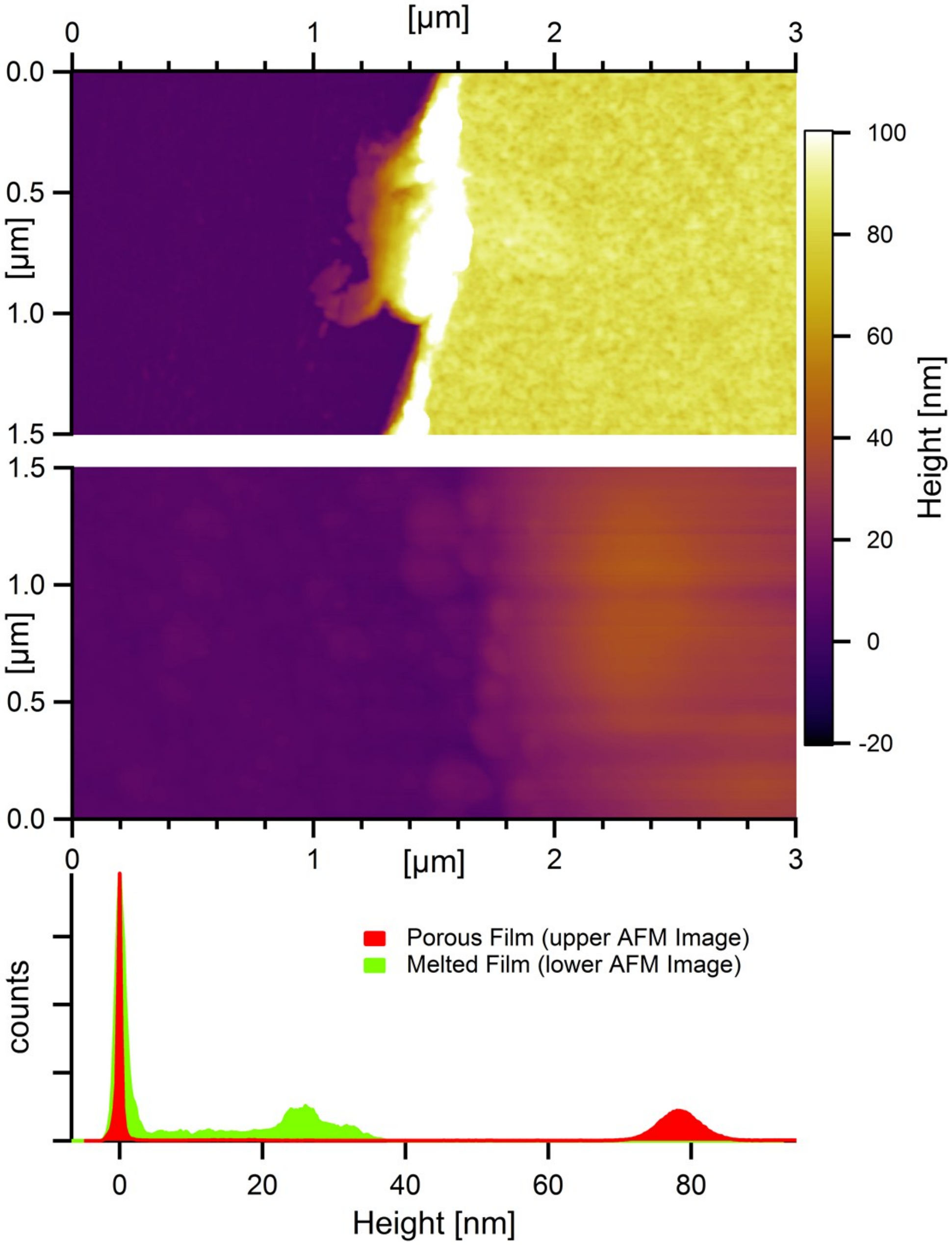

Figure S3: *AFM thickness measurements of the polymer films. The film was scratched and the film thickness was determined across the step. The glass substrate can be seen on the left side of the images, while the polymer film is on the right side. The top graph shows the porous PMMA film as used for the antireflection measurements. The middle graph shows the same film (and scratch) after the sample had been heated up above the glass transition temperature of PMMA under reduced pressure. The height of the film decreased by approximately 70 %, which can be easily verified in the histograms in the lower section of the graph.*