Polymer replication of self-assembled nanosurface

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Publication date: 2019

Document Version
Peer reviewed version

Citation (APA):
Polymer replication of self-assembled nanosurface

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We fabricated poly(methyl methacrylate) (PMMA) surfaces comprised of pillars arranged in a hexagonal array with pillar-to-pillar distance of order ~70 nm. The pillar diameter was of order ~50 nm and had aspect ratio close to one. The pillar array was originated from self-assembly of polystyrene - polydimethylsiloxane (PS – PDMS) block – copolymer, which was transferred to a Si surface by in-situ lithography, and steps of reactive ion etching. We used the pillar array surfaces to study the anti-fogging effect. In this study, we found that an ultrathin (~10 nm) coating by tungsten could be used to tune the hydrophilicity of the surface. The samples were highly transparent with a transmittance above ~85% in the visible spectrum due to the sub-diffraction limit feature-sizes and the sub-optical thickness of the W coating. By means of optical transmission microscopy, we found that the anti-fogging effect is related to an observed hemiwicking flow on the surfaces. This observation was done by tracking the water droplet fronts on the surface.

For the fabricated surfaces, we demonstrated the anti-fogging behavior to be stable over time during at least two months.

![Figure 1](image)

**Figure 1:** (a) Tracking of droplet front displacement ($x_1$), and displacement of the wicking film-front ($x_2$) as indicated in transmission image (b). (c) Injection molded ø50 mm transparent PMMA sample with the nano-texture and coated with a thin layer of W. (d) Micrograph showing the nanoscale texture.

References

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