Novel polymer resins for ultraviolet light assisted nanoimprint lithography applications

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Ultraviolet light assisted (UV)-nanoimprint lithography (UV-NIL) [1] is considered to be one of the edge cutting micro and nano-fabrication techniques by which nano structures can be replicated from a mold on to a suitable rigid or flexible substrate. An emerging variant of UV-NIL, which allows high-volume industrial scale application and commercialization, is the so-called ultraviolet light assisted roll-to-roll NIL (UV R2R NIL)[2]. During this process, an imprinter roller with a patterned surface is used to imprint into a thin photocurable resist material which has previously been coated on a flexible substrate.

In this paper, we present a library of photocurable solvent-free resins based on the two standard photocuring chemistries which are based on the cationic polymerization and free-radical polymerization mechanisms. A variety of acrylic and epoxy resins suitable for R2R NIL, which yield highly crosslinked polymers after exposure to UV light, have been developed by our research groups. These solvent-free formulations cure via free-radical and cationic polymerization processes respectively. In respect to the requirements of the final application, we discuss their tunable physical/chemical properties and present their unique functionality when combined with micro/nano structures.

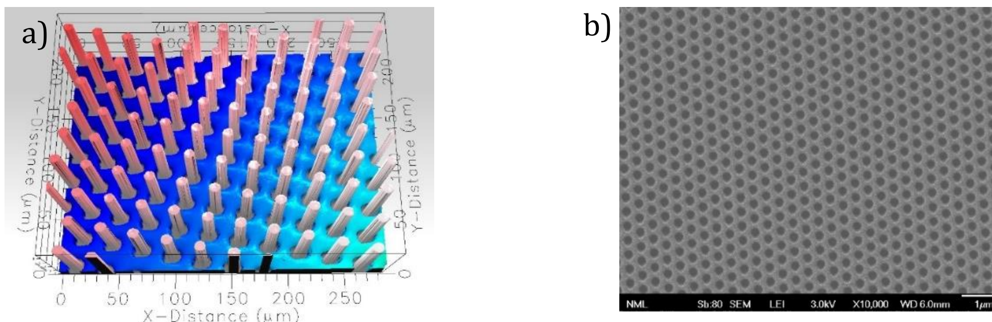

Figure 1: a) 3D optical profilometry image of micropillars imprinted on acrylic resin and b) SEM image of submicron-sized holes imprinted on epoxy resin

References

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[2] J.J. Dumond, H.Y., Journal of Vacuum Science & Technology B 30, 010801 (2012)

Acknowledgments

This work was supported by the research project “Advanced inline nano-metrology techniques for roll to roll nanoimprint lithography manufacturing processes, NanoMet” - MIS 5056202, funded by the Operational Programme (EPAnEK) "Competitiveness, Entrepreneurship and Innovation" (NSRF 2014-2020), under the special action "Industrial Materials" and co-financed by Greece and the European Union (European Regional Development Fund).