A significant vaporized degradable film assisting demoulding technics in nanoimprinting lithography

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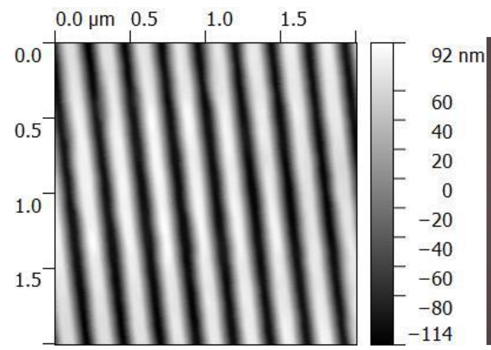
A mold for nanoimprint lithography typically has a high density of nanoscale protrusion features on its surface. This effectively increases the total surface area that contacts the imprinted polymer, leading to a strong adhesion of the imprinted polymer to the mold. One of the key issues of successful NIL technology is to avoid adhesion of the polymer to the stamp. Solutions to this problem are: incorporating an internal release agent into the resist, applying a low-surface energy coating to the mold; choosing a mold material with an intrinsically low surface energy [1,2]. Here, we seek for a new way to solve this problem, using some degradable natural products to form a very good anti-adhesion property on the substrate. The fabrication process can be integrated to roll-to-roll production line, yielding very low cost and flexibility.

We choose PVA (alcoholysis degree: 74%; MW, 44.05) to overcome the drawback of stripping off in nanoimprint process. At high temperature, it will decompose into small molecules, like CO_2, H_2O et al. In details, Poly(methyl methacrylate) (PMMA) solution in toluene (5 wt %) was spin-coated on Si wafer to achieve a thin film. Then Polyvinyl alcohol (PVA) water solution with a 0.01mg/ml concentration were spin coated above the PMMA film to form a 20nm thin film. Si grating mold with 700 nm period and 50% duty cycle was used to achieve the designed patterns. After nanoimprint process, a transformed pattern in the PMMA films was achieved [fig1,2].



[1] Chou Stephen Y，Keimel Chris，Gu Jian． Ultrafast and direct imprint of nanostructure in silicon［J］ Nature，2002，4, 17: 835－837．

[2] Guo L J．Recent progress in nanoimprint technology and its applications. ［J］. J. Phys. D: Appl. Phys. 2004，37: R123－R141．