Direct patterning of thickness controllable poly (methylmethacrylate) (PMMA) micro-patterns on a nanometer scale onto SiO_2 substrates

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Poly(methylmethacrylate) (PMMA) film has played very important roles in micro-fabrication process of present semiconductor technologies as chemical as well as physical passivation layers in metal deposition, film etching, and ion implantation. Recently, polymer film has been also applied to a dielectric and insulating layer of thin film transistor, a passivation layer for maintaining electric device performance. In this work, we report on the facile patterning of PMMA layers onto SiO2 substrates via micro-contact printing combined with the simplified Langmuir-Schaefer (LS) technique. Specifically, Langmuir film of PMMA was formed just by dropping a dilute PMMA solution onto the air/water surface in a glass Petri dish via molecular self-assembly and it was used as an ink for the PDMS stamp. Therefore, we could simply obtain thickness-controlled PMMA patterns on a nanometer scale owing to the advantage of the LS technique, whereby the Langmuir film of PMMA on the water surface could be delicately deposited on the stamp. The patterned thin film had no pinhole and showed a sub-nanometer RMS roughness after a post-annealing process.