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Micro-patterning for Biomimetic Functionalization of Surface

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Some living thingsuse micro- or nano- structures for living in nature. Scientists and engineers made efforts to mimic them, and they succeeded in making new types of applications. They used 'Namib desert beetle' to self-filling device by moisture harvesting and 'lotus leaf' to self-cleaning device by water repelling. 'Namib desert beetle' and lotus leaf have micro-patterns on their surface, which consists of hydrophobic or hydrophilic materials [1]. Moreover, micro-patterns on the surface make self-filling or self-cleaning property enhanced because of the surface roughness. Surface roughness enhances wettability [2]. Micro-pattern is a significant factor to make the surface be functional, so we want to make new types of functional surface by micro-patterning. In this work,we make several functional micro-patterns (radial, line, and dot arrays) using maskless lithography and analyze the characteristics of each micro-pattern. In order to analyze and understand surface characteristics, micro-patterns with varying sizes are investigated. All experiments are proceeded on mr-DWL5 photo resists coated on silicon wafers in same condition. All the experiments have demonstrated good performances about hydrophobic or hydrophilic property corresponding to their material and structural combinations. In radial micro-pattern, although the surface is flat, water drops on hydrophilic radial pattern can be convergent to a middle point and water drops on hydrophobic radial pattern can be divergent from the middle point. In line array micro-pattern, water drops can roll off along only one direction in parallel with the line arrays. Such phenomena might be mainly caused by the local change of surface roughness. From these results, controlling the movement and direction of water drops is made feasible without introducing a slope, which can potentially be used for new types of applications.

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