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Characterization of Oleophobic Functional Surfaces Fabricated by Thermal Imprinting Process

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Extended Abstract

Nanostructure is the prerequisite to obtain an appropriate surface roughness for the superhydrophobicity or oleophobicity. Synthetic surfaces with nano-sized bumps have been recently developed based on low-energy surface and multiscale roughness by various nanotechniques [1]. Especially, antifouling, deicing, antibacterial, and self-cleaning surfaces are important for improving the energy efficiency of building, automobile, medical devices, and household care [2]. During the past two decades, superhydrophobic nanostructures and nanocoatings that are inspired by the lotus-leafs effect have been extensively studied. However, studies on the oloephobic surfaces were paid less attention. Therefore, it is a challenge to create functional surfaces which completely resist wetting not only by water, but also by organic liquids such as oils [3].

In this work, a study on fabrication and characterization of oleophobic (repellent to oil) surface using thermal imprint lithography is conducted. For thermal imprinting process, a nickel (Ni) stamp with pillar-array was fabricated. During the imprint lithography, the PMMA (polymethyl methacrylate) substrate was prepared and heated above the glass transition temperature. As a result, the micro-patterned PMMA sheet was successfully formed [Fig. 1]. By application of fluoride coating (DURASURF, HARVES. Co.) and polymer nano-particles stacking on the micro-patterned PMMA sheet, a surface modification was carried out. Thus, the hierarchical complex surfaces which have superhydrophobic and oleophobic properties with complex nano-particles on micro-patterns were created.

This hierarchical structure played an important role in oil-repellent properties. As a result, the imprinted surface from nickel stamp showed contact angle around 150° for water and 118° for hexadecane. This method can be applicable for a variety of applications such as self-cleaning, antifouling, and antifrosting. Furthermore, we will discuss the mechanism of creating an oleophobic coating in details.

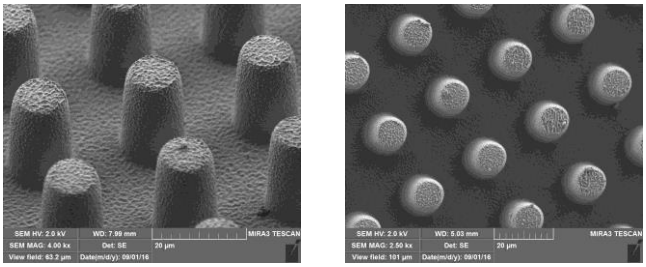

Fig. 1: Micro-patterned bump array using PMMA by thermal imprinting process.

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