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**Superhydrophobic nano-hair mimicking for water strider leg using CF<sub>4</sub> plasma treatment on the 2-D and 3-D PTFE patterned surfaces**Bongsu Shin<sup>1</sup>, Myoung-Woon Moon<sup>2</sup>, Ho-Young Kim<sup>1</sup>, Kwang-Ryeol Lee<sup>2</sup><sup>1</sup>Seoul National University, Seoul, South Korea <sup>2</sup>Korea Institute of Science and Technology, Seoul, South Korea

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Similar to the superhydrophobic surfaces of lotus leaf, water strider leg is attributed to hierarchical structure of micro pillar and nano-hair coated with low surface energy materials, by which water strider can run and even jump on the water surface. In order to mimick its leg, many effort, especially, on the fabrication of nanohairs has been made using several methods such as a capillarity-driven molding and lithography using poly(urethane acrylate)(PUA). However most of those effort was not so effective to create the similar structure due to its difficulty in the fabrication of nanoscale hairy structures with hydrophobic surface.

In this study, we have selected a low surface energy polymeric material of polytetrafluoroethylene(PTFE, or Teflon) assisted with surface modification of CF<sub>4</sub> plasma treatment followed by hydrophobic surface coating with pre-cursor of hexamethyldisiloxane(HMDSO) using a plasma enhanced chemical vapor deposition(PE-CVD). It was found that the plasma energy and duration of CF<sub>4</sub> treatment on PTFE polymer could control the aspect ratio of nano-hair structure, which varying with high aspect ratio of more than 20 to 1 and 50 to 1 on 3-D substrate(stainless steel wire), or height of over 1000nm but width of 50nm in average. The water contact angle on pristine PTFE surface was measured as approximately 115°. With nanostructures by CF<sub>4</sub> plasma treatment and hydrophobic coating of HMDSO film, we made a superhydrophobic nano-hair structure with the wetting angle of over 160°. This novel fabrication method of nano-hair structures has been applied not only on 2-D flat substrate but also on 3-D substrates like wire and cylinder, which is similarly mimicked the water strider's leg.

**Keywords**

PTFE

CF<sub>4</sub> plasma

water strider

superhydrophobicity

nano-hair