

Sensitivity of Thermo-Moisture Responsive Shape Memory Polymer Controlled by Imprinted Nano-Micro Patterns

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We have developed a thermo-moisture responsive polymer (TMP) which consists of two components of hydrophobic material and hydrophilic material. TMP type shape memory polymer can change its shape under specific temperature and relative humidity (RH) while hydrophilic polymer absorbs water and swells. Such a smart material can be useful for self-adaptive textiles for energy savings and other actuator devices. The molecular interaction between polymer and water is now based on van Oss-Chaudhury-Good theory¹. In the present study, hydrophilic material for TMP has been chosen so as to adjust the contact angle with water droplet.

In this study, nano-micro patterning has been applied onto the surface of material to dramatically increase the characteristics toward water². We found that the hydrophilic polymer in TMP can absorb water more easily by imprinting nano-micro patterns on its surface, thus enabling to control the pattern shape under specific thermo- moisture environments. PEO (polyethylene oxide) and PMMA (polymethyl methacrylate) were utilized as hydrophilic and hydrophobic material, respectively, in this study. A Si wafer mask patterned by E-beam and chemical etching was used to imprint patterns on TMP.

¹ Van Oss, C. J., Good, R. J., & Chaudhury, M. K. (1988). Additive and nonadditive surface tension components and interpretation of contact angles. *Langmuir*, 4, 884-891.

² Marmur, A. (2003). Wetting on hydrophobic rough surfaces: To be heterogeneous or not to be? *Langmuir*, 19, 8343-8348.