Wei Li Lee et al., J Material Sci Eng 2016, 5:7 (Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.046

Mechanically deformable and programmable nanoscale surface textures with tunable wetting and mechanical properties

Wei Li Lee[1,2], **Hong Yee Low**[2] and **Christine Ortiz**[1]
[1]Massachusetts Institute of Technology, USA
[2]Singapore University of Technology and Design, Singapore

Nanoscale surface textures, when optimally designed, present a unique surface engineering approach to improve surface functionalities. Coupling surface texture with shape programmable polymer may generate tunable surface properties. A shape memory polyether urethane was used to prepare 250 nm-pillar arrays. The mechanical deformation via stretching and recovery of the pillar arrays were investigated as a function of aspect ratios. Scanning electron microscopy and atomic force microscopy analyses showed the higher aspect-ratio (2.5:1) pillars exhibiting more deformation in height than low (l:1) aspect-ratio pillars under the same applied macroscopic strain. In the recovery study, the high contribution of surface energy impedes the complete recovery (~70%) of pillars. The nanopillar arrays were shown to perform switchable wetting function and surface mechanical properties (penetration resistance, modulus and buckling/bending), without changing materials or needing continuous external stress or energy inputs. For wetting, the 1:1 pillars exhibited decreasing water contact angles as the applied tensile strain (ε) increased from 0% to 200%, whereas the contact angles on the 2.5:1 pillars increased when changing $\varepsilon$from 0% to 100%, and began to decrease at high strain (ε=200%). In terms of surface mechanical behavours, the 2.5:1 pillars yielded a higher unloading modulus compared to the 1:1 pillars, as a result of distinct buckling/bending mechanisms. In addition, the modulus could be further engineered by deforming the pillar structure and its arrangement. This study provides insights into how the surface functionalities can be tuned by manipulating geometrical designs of surface patterns and varying applied levels of stretching during shape programming.

Biography

Wei Li Lee received his PhD degree from Nanyang Technological University (NTU), Singapore in 2012. He is currently working as a Post-doctoral Fellow at Massachusetts Institute of Technology (MIT). Before joining MIT, he was a Post-doctoral Research Fellow in NTU from 2012 to 2014, where he served as a Project Leader for Particle Fabrication and Drug-Carrier Formulations. He has developed 5 patents and published 19 peer-reviewed journal papers, including 15 first-authored *papers in Small, Journal of Controlled Release, Acta Biomaterialia,* etc. He also presented his works at several international conferences held in the US, Europe and Asia, and won several academic awards.

weililee@mit.edu

Notes: