

Fabrication of Bent Janus Nanopillars and Their Applications to Gecko-like Dry Adhesives

윤현식, 서갑양¹, 차국현*

서울대학교 화학생물공학부; ¹서울대학교 기계항공공학부

(khchar@snu.ac.kr*)

We present a fabrication method to realize Janus nanopillars revealing the direction-dependent dry adhesive behavior. Polymeric nanopillars were first molded from an etched SiO₂ substrate with high aspect ratio nanoholes, followed by the oblique metal deposition on polymer nanopillars such that metal layers in different thickness were coated only on one side of the pillars. The Janus nanopillars could be bent during deposition or by additional thermal annealing. The bending mechanism for the nanopillars toward the metal layer by thermal annealing can be explained by the mismatch in thermal expansion coefficient between metal and polymer, followed by the plastic deformation of polymeric pillars. What is strikingly interesting is that these bent Janus nanopillars show even more pronounced adhesion hysteresis: strong shear attachment when pulled from the bent direction in contrast to easy detachment from the opposite direction just like Gecko-like adhesives. We also demonstrate that this type of bending process for Janus nanopillars has a definite advantage for the large area fabrication.