Smart Nanohair Adhesive for Flexible and Highly Sensitive Skin Sensors

서갑양*, 방창현[1], 김상문[1], 이찬석[1]

서울대학교; [1]서울대학교 기계항공공학부

(sky4u@snu.ac.kr*)

The efforts to learn and take inspiration from nature have proven successful in a wide range of areas such as epidermal electronics, dry adhesion, etc. Among many useful functions, reversible binding or interlocking is an attractive feature that nature can provide, which is enabled by a number of different intermolecular, capillary, electric, and mechanical forces. In addition, nature has created unique structural devices with specially designed physical structures such as interlocking between "hooks" and "loops" in burdock's seeds (fabric Velcro) and insect locking systems. We report that the wing locking device of beetles can be exploited to form a reversible interlocker based on van der Waals force-assisted binding between high aspect-ratio polymer hairs made of UV-curable polyurethane-based materials. For potential applications to multifunctional mechano-sensitive devices, a sandwiched assembly of interlocked PUA layers between thin elastomeric supports of PDMS is constructed. The assembled device demonstrates an excellent gauge factor of ~11.45 and can measure simultaneously three different mechanical stimuli such as pressure, shear force, and torsion with high sensitivity and wide dynamic range.