

Flexible Electronic Skins

Hyunhyub Ko¹

¹School of Energy and Chemical Engineering, Ulsan National Institute of Science and Technology (UNIST),
Ulsan Metropolitan City 689-798, Korea

Tel: 82-52-217-2532, E-mail: hyunhko@unist.ac.kr

Flexible electronic skins with high tactile sensitivities have gained great attentions in the fields of wearable sensors, robotic skins, and biomedical diagnostics. Here, we introduce highly-sensitive, multifunctional, and stretchable electronic skins based on interlocked design of micro- and nanostructured hybrid materials. Inspired by the interlocked microstructures found in epidermal-dermal ridges in human skin, piezoresistive interlocked microdome arrays are employed for stress-direction-sensitive, stretchable electronic skins. The interlocked microdome arrays provide a giant tunneling piezoresistance due to the enhanced change in inter-microdome contact area in response to various mechanical stimuli, leading to high tactile-sensing capabilities. We show that the interlocked microdome arrays possess highly sensitive detection capability of various mechanical stimuli including normal, shear, stretching, bending, and twisting forces. In addition, the unique geometry of interlocked microdome arrays enables the differentiation of various mechanical stimuli because the arrays exhibit different levels of deformation depending on the direction of applied forces, thus providing different sensory output patterns. Bioinspired e-skin design of hierarchical micro- and nanostructured ZnO nanowire (NW) arrays in an interlocked geometry is suggested for the sensitive detection of both static and dynamic tactile stimuli through piezoresistive and piezoelectric transduction modes, respectively. Finally, we show that the stretchable electronic skins attached on the human skin can be used as wearable healthcare monitoring devices, which are able to distinguish various mechanical stimuli applied in different directions, selectively monitor different intensities and directions of air flows and vibrations, and sensitively monitor human breathing flows and voice vibrations.

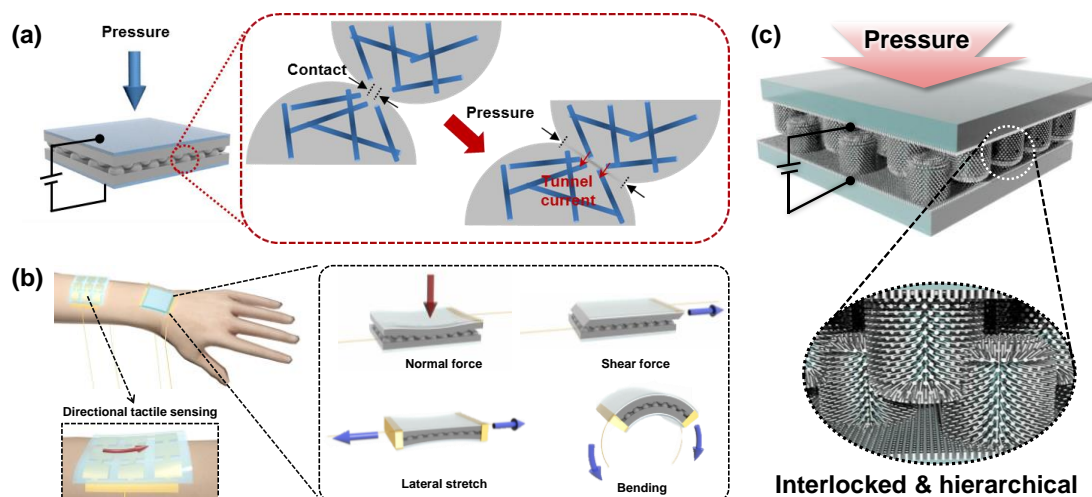


Fig. 1. Flexible electronic skins based on interlocked microdome arrays and hierarchical structures for the detection and differentiation of various mechanical stimuli from different directions.

References

1. Jonghwa Park et al., *ACS Nano*, **2014**, 8, 12020.
2. Jonghwa Park et al., *ACS Nano*, **2014**, 8, 4689.
3. Minjeong Ha et al., *Adv. Funct. Mater.* **2015**, ASAP (DOI: 10.1002/adfm.201500453)