Abstracts

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Hydrogen Bond-Triggered Ultrasensitive and Broad Range Pressure Sensor for Wearable Healthcare Monitoring

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Abstract

In this work, a novel approach was presented to enhance the sensitivity and working range of a capacitive pressure sensor by fabricating a hybrid ionic nanofibrous membrane as the sensing layer composed of Ti3C2Tx (MXene) and an ionic salt of lithium sulfonimide in a polyvinyl alcohol elastomer matrix. The results of this study revealed that the functional layer on the MXene surface trapped ions via H-bonds, which considerably decreased its initial capacitance by inhibiting the EDL formation at the electrode/electrolyte interface. The ion pumping process triggered by external stimuli generated a thick EDL at the interface, causing a significant capacitance change and ensuring ultra-high sensitivity of the device. The reversible ion pumping of the hybrid sensing layer lead to ultra-high sensitivities of 5.5 and 1.5 kPa–1 in the pressure ranges of 0–30 and 30–250 kPa, respectively, and a fast response time of 70.4 ms. In addition, the nanofibrous membrane promoted the device operation in a broad pressure range due to its higher degree of compressibility as compared with that of the micro structured film. Thus, the developed sensor exhibited much superior performance as compared with the majority of the recently reported capacitive pressure sensors with the EDL-based sensing mechanism. Its performance characteristics were also validated under various pressures (from ultralow to large deformations), and possible applications of this sensor in physiological signal monitoring and artificial e-skin are verified.

Biography

He received his B.E. degree in Electronics and Communication Engineering from Western Region Campus, Tribhuvan University, Nepal. Currently, He is a PhD student under supervision of Dr. Jae Yeong Park in the Department of Electronic Engineering at Kwangwoon University, Seoul, South Korea. He is doing research in material science and engineering. His main research interests include flexible and wearable electronics.

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