Electro-Mechanically Responsive Ionoelastomer Heterojunctions

김형준†
서강대학교
(hjunkim@sogang.ac.kr†)

Soft solids capable of conducting ions offer promise for the design of entirely new classes of highly deformable and bio-inspired devices. Here, we introduce 'ionoelastomers'—soft polymer networks capable of selectively conducting either anions or cations—to demonstrate liquid-free, elastic, and stretchable ionic diodes and transistors that operate entirely via non-Faradaic processes. We show that the junction of two oppositely charged ionoelastomers yields an 'ionic double layer', analogous to the depletion layer in a semiconducting p-n junction. This enables the design of ionic devices for rectifying and switching non-Faradaic ionic currents. Furthermore, soft and stretchable ionoelastomer junctions provide fundamentally new functionalities including: 1) low voltage reversible electro-adhesion and 2) electro-mechanical transduction, i.e., the conversion of mechanical deformation into electrical signals. Our studies provide new fundamental insight on the interface between two oppositely charged ionoelastomers and open opportunities for the application of these soft ion-conducting devices.