Elastomers, Gels, Textiles and Their Composites in Biomedical Devices and Sensors

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Biomedical devices and sensor research has been widely exploiting soft elastomers and gels reinforced with hard structures such as woven/knitted fibers or 3D printed structures, often with conductive/ magnetic components for active functionalities. Elastomers, natural or synthetic polymers that have soft, deformable, and resilient mechanical properties have traditionally been used in biomedical applications owing to their similarity to soft tissues in terms of mechanical properties. In fact, soft tissues in biological systems are fiber-reinforced gel materials. Soft material and device lab (SMDL) aims to develop biomedical devices and sensors based on the understanding of physicochemical properties of elastomers, gels, and their composites with functional or non-functional reinforcements. In the presentation, I will share a few recent achievements in SMDL. Firstly, our recent works in developing neo-aorta material for ex-vivo heart perfusion (EVHP) device are introduced. Secondly, I introduce our two-layered e-textile patches by controlled permeation of Ag-particle/fluoropolymer composite ink into porous textile substrate. Here, we demonstrate surface electromyography (sEMG) and electroencephalography (EEG) systems with wireless data emission. Thirdly, our recent works on the end-of-life sensor for firefighters' protective garment will shown. Finally, our works on understanding the physicochemical properties of tough hydrogels and their applications in electronic skins are showcased.

Short Biography:

Hyun-Joong Chung is a materials engineer who leads a broadly interdisciplinary research program on understanding physicochemical properties of gels and elastomers with or without functional additives and reinforcements, as well as on translating fundamental understanding to biomedical and energy device applications. His significant contributions includes key studies on the role of jamming nanoparticles in phase-separating polymer blends; his works on oxide semiconductors and wearable devices which have been highly recognized by international information display and flexible electronics communities. His 68 peer-reviewed papers/conference proceedings and 11 patents were cited >10,400 times (h-index 35).