



Department of Materials Science and Engineering Seminar Series 2026

Conductive Polymer Blends as Self-Adhesive and Stretchable Electrodes for Electrophysiological Monitoring

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Date and time: 6th November, 9:30am

Venue: EA-02-14

Abstract

Epidermal biopotential signals, such as electrocardiogram (ECG) and electromyogram (EMG), provide important information for disease diagnosis, health monitoring, and rehabilitation. Flexible dry electrodes based on soft elastomers and intrinsically conductive polymers, particularly poly(3,4-ethylenedioxythiophene):poly(styrene sulfonate) (PEDOT:PSS), offer a promising alternative to conventional Ag/AgCl gel electrodes for continuous electrophysiological monitoring. However, maintaining reliable electrode contact during movement and water exposure remains challenging. Similar challenges arise at implantable electrode–tissue interfaces, where wet environments and physiological deformation can disrupt electrical contact. These applications therefore require materials that combine durable adhesion, high conductivity, and tissue-matched mechanical properties.

Accordingly, we develop PEDOT:PSS-based conductive polymer blends as self-adhesive and stretchable electrodes for epidermal and implantable electrophysiological applications and investigate their underlying adhesion mechanisms.

The first part develops a conductive polymer blend that combines conductivity, stretchability, and biocompatibility with water-enhanced skin adhesion. The underlying adhesion mechanism is systematically investigated. The resulting electrodes maintain prolonged conformal contact with skin underwater and enable high-quality, non-invasive biopotential monitoring in humans and amphibious turtles under both dry and underwater conditions.

The second part focuses on establishing stable electrical contact with soft, wet tissues through a self-adhesive, stretchable conductive polymer blend. The blend can adhere immediately to tissues and maintain electrical and mechanical stability during prolonged immersion and repeated stretching.

Together, these studies establish design strategies for integrating conductivity, stretchability, and durable adhesion in PEDOT:PSS-based blends for electrophysiological monitoring.

Biography

Zeng Zhihan received his bachelor's degree from Soochow University of China in 2021 and his master's degree from the National University of Singapore (NUS) in 2022. He is currently a Ph.D. candidate in the Department of Materials Science and Engineering at NUS under the supervision of Prof. Ouyang Jianyong. His research focuses on the design of conductive polymer blends for electrophysiological monitoring.

Please join us!

HOST: Asst Prof Jing Yan