Electro-mech-chemical coupled corrosion resistance mechanism of poly(3,4-ethylenedioxythiophene) accelerated polyurethane self-healing coating on electronic materials

Jinlin Yang, **Tianrui Sun,** Xin Ma ,Guanzheng ,Liu Kexin Liu, Yan Zhu, Mengyu Wang,
Junyan Li, Xiaoxia Bai*,
Key Laboratory of High-Orbits-Electron Materials and Protection Technology for Aerospace, School of Advanced Materials and Nanotechnology, Xidian University，Xi'an 710126, China

Presenter's e-mail address: s13839816058@163.com

Abstract The exploitation and utilization of marine resources have driven the need for enhanced integration, miniaturization, and precision in marine electronic equipment. Even minor corrosion can severely disrupt electronic systems, leading to operational failures. Self-healing coating holds great promise as a alternative to highly toxic and carcinogenic chromate coatings, addressing the issue of corrosion in electronic materials in an eco-friendly and efficient manner. This study fabricated poly(3,4-ethylenedioxythiophene) (PEDOT) hollow microspheres doped and coated with corrosion inhibitors via emulsion polymerization, employing cellulose nanocrystals (CNC) as a soft template to encase linseed oil and waterborne polyurethane (WPU) as the base material, to develop a PEDOT/LO/WPU bi-component smart anti-corrosion coating for metal protection in simulated marine environments.The coating's exceptional self-healing capability was confirmed by scanning electron microscopy (SEM).The coating's self-healing and anti-corrosive properties were extensively researched using electrochemical testing techniques, such as polarization curves and electrochemical impedance spectroscopy. Analysis of the impedance spectrum's equivalent circuit revealed a novel self-healing anti-corrosion mechanism in the PEDOT/LO/WPU coating.This research contributes to the development of more efficacious anti-corrosion materials and strategies, enhancing the stability and reliability of electronic components.

Keywords PEDOT/LO/WPU; Dually self-repairing coating; Corrosion inhibitor; Corrosion resistance