Silicon-based full spectrum photoanode for continuously photoelectrochemical cathodic protection of shipboard electronic equipment

Xiaoxia Bai*, Jinlin Yang, Guanzheng Liu, Xin Ma, Tianrui Sun, Kexin Liu,

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: xxbai@xidian.edu.cn

Abstract As a novel green anti-corrosion technology, photoelectrochemical cathodic protection has gradually become an important approach for metal corrosion prevention. Nevertheless, conventional titanium dioxide-based photoanodes are inefficient and unable to offer continuous protection in the dark. Silicon possesses excellent light absorption characteristics. By constructing a p-n heterojunction composite photoanode, the photoelectric conversion efficiency can be enhanced, yet it remains difficult to achieve continuous protection without light. In this study, we propose to combine n-type silicon nanowire arrays (SiNWs) with high specific surface area and organic semiconductor PEDOT:PSS to construct a new type of photoanode, and then combine it with copper-sulfur compounds (Cu2-xS) to improve photoelectric performance and anti-corrosion capability. It is found that the current density of PEDOT:PSS/SiNWs photoanodes is significantly increased under visible light, which leads to the open circuit potential decrease much lower than that of corrosion potential for the metal. Especially the photoanode can still provide continuous protection after light off for more than several hours. The introduction of Cu2-xS further enhances light absorption and electron transport, thereby improving cathodic protection.

Keywords：*Photocathodic protection;* PEDOT:PSS/SiNWs; Silicon nanowire arrays; Anti-corrosion