Multifunctional Graphene Oxide-Polymer Composite for Anti-Corrosive Coating Applications

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Abstract

Metallic corrosion, particularly in steel, remains a global economic and safety challenge. Hence, we require innovative and multifunctional coatings engineered for superior durability. The graphene oxide-polymer composite coatings developed in the present study exhibit an ultralow corrosion rate of 10^{-7} mmpy. The corrosion rates were measured using an electrochemical workstation with a custom-made corrosion cell, which enables accurate electrochemical measurements on substrates of different sizes. By optimizing the solvent-thinner ratios and integrating a silane coupling agent, the system achieves superior interfacial adhesion of 5B (per ASTM D3359), with a ~90° contact angle indicative of higher hydrophobicity. It demonstrated exceptional environmental durability, exceeding 2000 hours in salt-spray testing (per ASTM B117). The developed coating has potential compatibility with standard industrial application techniques.

References

[1] Z. Yu, H. Di, M. Yu, Y. He, L. Liang, X. Ran, Y. Pan, Z. Luo, Surf. & Coat. Technol., 276 (2015), 471-478.

[2] S. Yang, S. Zhu, R. Hong, Coatings, 10 (2020), 1215

Figures

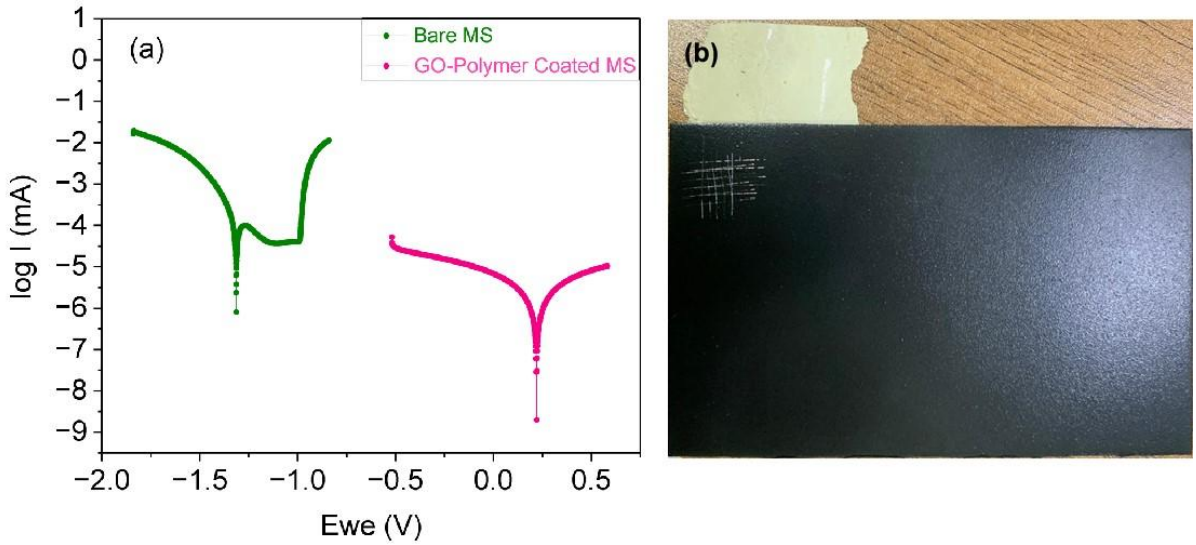

Figure: (a) Tafel plot comparing corrosion rates of bare mild steel (MS) substrate and MS substrate coated with GO-polymer composite. **(b)** Adhesion Test on substrates coated with GO-polymer composite