Temperature Assisted Self-Curable Coating with Graphene-Polymer Composite

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Abstract
The development of advanced protective coatings is crucial for addressing the challenges of corrosion in metals exposed to harsh environments since conventional coatings provide only passive protection and often require regular care. We have prepared a temperature assisted self-curing protective coating formulation based on graphene modified polymer composite. The rheological studies of the coating formulations confirmed the shear thinning behavior of the prepared formulation which aids for the easy application process. This formulation can be coated on large metal substrates/sheets using industrially viable methods like spray coating. The graphene-polymer composite coating has the ability to repair micro-scratches, enhancing the service life of metal substrates. In order to test the healing properties of the coating, manual cut was made on the coated substrate followed by thermal treatment using a normal spray gun. Healing efficiency was evaluated by the ratio of cut width before and after healing. We could achieve a maximum healing efficiency of 88-95%. To confirm further, we have also carried out corrosion protection rate (CPR) before and after healing. The CPR analysis of the Graphene-Polymer (G-P) composite coated substrate shown a corrosion rate 1.87 x 10^{-6} mmpy and that after healing gave a corrosion rate 43.80 x 10^{-6} mmpy indicating there is not much degradation in coating. The wettability studies using water contact angle (WCA) measurements revealed the coated surface before and after healing to be hydrophobic (90 -100 °).

References

[1] R.H. Aguirresarobe, S. Nevejans, B. Reck, L. Irusta, H. Sardon, J.M. Asua, N. Ballard, Prog. Polym. Sci., 114 (2021), Article 101362.
[2] AZ.P. Zhang, M.Z. Rong, M.Q. Zhang Prog. Polym. Sci., 144 (2023), Article 101724

Figures

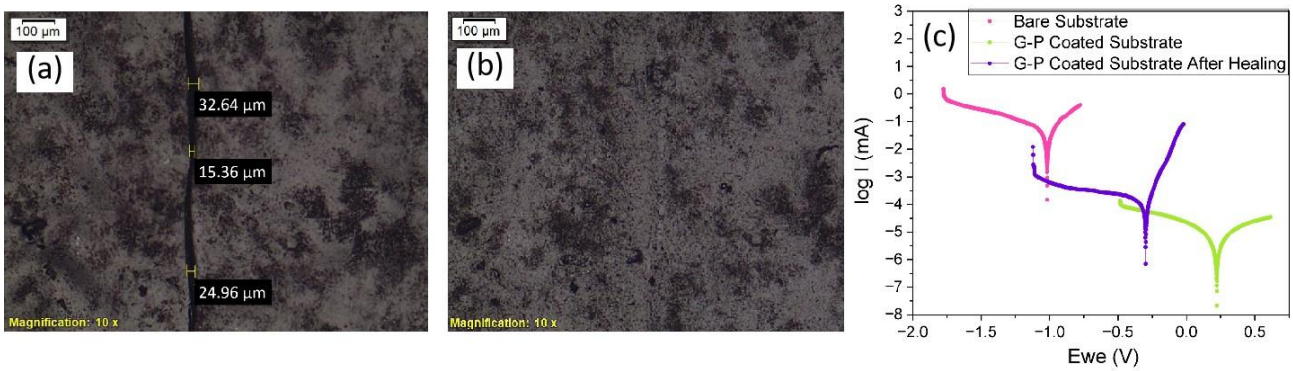

Figure: (a) Microscope Images of the coating with micro scratch before healing **(b)** Microscope Images of the coating after healing the micro scratch **(c)** Tafel Plot comparing the corrosion studies of bare mild steel substrate, Mild steel substrate coated with Graphene- Polymer (G-P) composite and Mild steel substrate coated with Graphene- Polymer composite after the Micro Scratch is healed.