Fluoropolymer-based coatings with enhanced corrosion resistance and surface adhesion

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Abstract Fluoropolymers are gaining interest from the coating industry due to their mechanical strength, thermal stability, hydrophobicity, and chemical resistance. However, their nonstick nature limits their applications as it often leads to poor film adhesion to various surfaces. In this work, we explore the efficacy of soybean extract (SE) and polyaniline (PANI) primer in improving the surface adhesion of poly(vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP) coatings, while minimizing the effects of corrosion. The adhesion improvement by SE can be attributed to the presence of abundant heteroatoms and pi-electrons from isoflavones in the extract and their capability to facilitate interactions at the coating-metal interface. Meanwhile, electrodepositing PANI primer also led to enhanced adhesion of PVDF-HFP and provided an additional protective layer warranting defect-free configurations. Overall, these strategic approaches are aimed at maximizing the benefits of fluoropolymer properties across a wide array of surface protection applications.

Keywords: fluoropolymer, polyaniline, soybean, coatings, corrosion, adhesion

Reference

[1] Ali, M. R. R.; Tigno, S. D.; Honeyman, J. S.; Caldona, E. B. Adhesion-diffusional-based corrosion protection mechanisms of polyaniline-primed fluoropolymer coatings. ACS Appl. Polym. Mater. 2024, 6 (5), 2719–2732.

[2] Caldona, E. B.; Smith Jr., D. W.; Wipf, D. O. Surface electroanalytical approaches to organic polymeric coatings. Polym. Int. 2021, 70 (7), 927–937.

[3] Domalanta, M. R. B.; Ferdousi, S.; Delas Armas, E. G.; Jiang, Y.; Caldona, E. B. Interfacially adhesive corrosion protective fluoropolymer coatings modified by soybean extract. Chem. Eng. J. 2024. (Under Review)