

Zeolite-Modified Plasma Electrolytic Oxidation (PEO) Coatings for Photocatalytic Applications

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Photocatalytic degradation has appeared as a promising approach for the removal of organic pollutants; however, conventional systems based on suspended photocatalyst powders are hindered by particle agglomeration, limited light penetration, and the need for catalyst separation after treatment. Plasma electrolytic oxidation (PEO) offers an attractive alternative through the fabrication of immobilized photocatalytic coatings directly on metallic substrates. Owing to the ability of PEO to incorporate electrolyte constituents into the growing oxide layer, composite coatings containing zeolite particles can be readily synthesized.

Recent advances in zeolite-modified PEO coatings demonstrate that the incorporation of natural and synthetic zeolites can significantly influence coating morphology, composition, porosity, and functional performance. In addition to providing adsorption sites for pollutant molecules, zeolites can serve as carriers for photocatalytically active species, enabling the development of multifunctional composite materials. The combination of the porous oxide matrix formed during PEO and the adsorption capacity of zeolites results in photocatalytic efficiency enhancement and subsequent broadening of the application potential of these coatings. Current research demonstrates that tailoring both the PEO processing conditions and zeolite modification strategies provides an effective pathway for engineering coating microstructures and optimizing the functional performance of immobilized photocatalytic systems.