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Comparative Study of TiO₂ Photocatalytic Coatings Deposited by SPPS and SPS Using an Axial III Plasma Torch

Abstract:

While the possibility of use of the thermal spray technologies for fabrication of photocatalytic coatings is already well examined, most of the studies focus on deposition from powder or suspension feedstocks, leaving solution precursor plasma spraying (SPPS) less explored. This is primarily due to the disadvantageous properties of most conventional precursors, such as aqueous titanium salts or alkoxides, of which high hydrophilicity and tendency toward premature precipitation lead to nozzle clogging and process destabilization.

In this study, we investigated the deposition of photocatalytic TiO₂-based coatings using both SPPS and suspension plasma spraying (SPS) with an Axial III plasma torch. Titanium(IV) bis(ammonium lactato)dihydroxide (TALH) was used as the stable water-based solution precursor, while the suspension was formulated from 100% sub-micrometric anatase powder with a distilled water as a solvent. The coatings were further characterized in terms of their microstructure through scanning electron microscope (SEM). The phase composition was acquired using X-ray diffraction (XRD), and the mechanical properties of the coatings were also assessed. Finally, the photocatalytic performance of the coatings was evaluated through the degradation of a methylene blue solution under UV irradiation, and the results for both SPPS and SPS coatings were compared.