Low-pressure cold spraying of suspension TiO_2 in a single pass – Process optimization

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Streszczenie

Efficient large-scale methods for production of photocatalytic coatings active in the visible light are still in demand. Photocatalytically active oxygen-enriched titanium dioxide was selected as the feedstock for low pressure cold spraying (LPCS). The oxygen enrichment was carried out on the sol-gel synthesis route to impair activity in the visible light. The titanium dioxide (TiO_2) feedstock in the form of suspension was applied to prevent the adverse impact of the delivered thermal energy on the unique chemical structure of the deposited material responsible for its photocatalytic activity. Additionally, the deposition of the suspension reduced the time of coating production by omitting the suspension drying step. Different coatings were produced by changing the spraying parameters (temperature of propellant gas, distance between beads, and manipulator traverse speed). The number of experiments was reduced to minimum by using Taguchi orthogonal array. First, the presence of the active groups in the low pressure cold sprayed coating was confirmed by combining results of Raman and EPR spectroscopy. Next, the response parameters (band gap energy (BGE) and surface area (SA)) were collected and analyzed. Performed ANOVA showed that the temperature of propellant gas has the most significant effect of 53.81 % and 56.62 % on the BGE and SA value, respectively. To show the activity of oxygen-rich TiO_2 coatings, the methylene blue degradation under visible light was performed for the optimal sample.

Słowa kluczowe

Cold spray, Suspension spraying, Titanium dioxide coatings, Taguchi method, Band gap energy