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Suspension formulation and thermal spray deposition of modified TiO_2 -based photocatalyst coatings for visible-light water splitting

Abstract:

Photocatalytic water splitting using visible light represents a promising approach for sustainable hydrogen production. However, pure TiO_2 exhibits limited activity in the visible spectral range due to its wide bandgap. This work aims to develop modified TiO_2 -based coating catalysts with extended visible-light response for photocatalytic water splitting.

Two feedstock concepts are pursued. First, binary suspensions consisting of TiO_2 and dopants such as TiC , TiN , Fe_2O_3 and ZnO were developed.

Second, calcined ilmenite was investigated as a low-cost, naturally Fe- and Ti-containing raw material and processed as a unary suspension. All suspensions were designed for the deposition of thin coatings via suspension thermal spraying. Preparation routes with low sedimentation rates, reduced viscosities, and optimal flowability were evaluated.

Structural and optical characterization of the deposited coatings was carried out by microstructural investigation, XRD, UV-Vis, Raman and FTIR analyses in order to assess the resulting coating properties.

This work establishes a first approach for the suspension-based processing of modified TiO_2 photocatalysts into visible-light-responsive, thermally sprayed coatings for solar hydrogen generation.