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PREDICTION OF TiO_2 AND WO_3 NANOPOWDERS SURFACE CHARGE BY THE EVALUATION OF POINT OF ZERO CHARGE (PZC)

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Abstract

Point of zero charge (PZC) is defined as the condition at which the surface charge density of a material equals to zero and, for most of the solids it is strongly pH dependent. The PZC can be controlled by tuning the solid surface properties (crystalline structure, morphology) and by a proper environment control, thus it is important to evaluate the PZC for a certain type of material, in given working conditions, for enhancing the efficiency in the targeted application (e.g. layer by layer thin films deposition, adsorption including (photo)catalysis).
TiO_2 and WO_3 are semiconductor materials with tremendous potential in environmental applications such as photocatalysis process used for water treatment. This paper presents the results obtained in PZC evaluation, by pH-titration, for the WO_3 nanopowder (~30 nm) and the state of the art - TiO_2 Deggusa P25. The pH titration was done using different amounts of TiO_2 and WO_3 nanopowders, in 0.1 M NaOH solution, by adding µL portions of 0.1 M HCl. Considering the WO_x Pourbaix diagram, experiments were also done using NH_4OH, for eliminating the Na_2WO_4 formation at the WO_3 surface. The PZC was evaluated on the derivative of the pH titration curve, at the significant peak(s). The PZC values were found strongly dependent on the chemical surface composition and only slightly dependent on the crystalline structure and morphology. The results proved that, in PZC reporting it is important to specify the experimental conditions, especially for highly pH-reactive solids like WO_3.

Key words: classic titration, point of zero charge, TiO_2 and WO_3 photocatalysts

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