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Use of mesoporous SBA-15 for nanostructuring titania for photocatalytic applications

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Abstract

SBA15–TiO_2 samples prepared by introducing titanium with a grafting method and having TiO_2 loadings below 15 wt.% have been characterized by XRF, XRD, IR, porosimetry, SEM, HRTEM, and UV–Visible diffuse reflectance. Differently from the samples reported in the literature characterized by a high TiO_2 loading, no evidences have been found for the presence of titania particles inside or outside the mesopores of SBA-15. Three different titanium species were instead evidenced to be present. The first two derive from the reaction of titanium with silanol groups in the corona area of inner SBA-15 walls leading to the formation of either TiO_4 tetrahedral sites (by reaction by hydroxyl nests of surface defect sites) and/or pseudo-octahedral surface sites anchored by two (or more) Si or Ti ions through bridging oxygens. The third species derives from the reaction of titanium in the regions with high sylanol density, e.g. in the micropores located in the corona of SBA-15 channels, leading to the formation of TiO_2-like nanoareas (probably Si-doped) with dimensions of around 1–2 nm maximum. The potential interest of these materials as photocatalysts, for the presence of a TiO_2-like nanoareas highly accessible by reactants, is discussed.

Keywords:

SBA-15; Titania; Mesoporous materials; Corona; Ti–silica mesoporous materials; Photocatalytic materials