

HIGH SURFACE AREA TITANIA PHOTOCATALYSTS IN THE ABATEMENT OF NO_x UNDER UV AND VISIBLE LIGHT IRRADIATION

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TiO₂ is considered the most promising photocatalyst for solar energy conversion and environmental applications, such as water and air purification, because of good photoactivity, high chemical stability, low cost and non-toxicity. Moreover it is well known as a large band gap semiconductor and when it is irradiated by a proper light ($\lambda < 387\text{nm}$), electrons are promoted across the band gap (3.2eV) into the conduction band, leaving holes in the valence band. These holes have a high oxidation power and they share in photooxidation reactions. TiO₂, in particular anatase, is an efficient photocatalyst for NO oxidation to NO₂^[1], however, the applications of pure TiO₂ are limited because it requires UV light for activation. For these reasons considerable efforts have been directed to expand the optical response of TiO₂ from the UV to the visible light region. The most promising results have been obtained by the introduction of transition metal ions such as V, W, or Fe into the titanium oxide, or by its modification with nonmetal atoms, such as S, C or N, favouring the decrease of the band gap energy^[2].

In the present work we have tested the activity of various TiO₂ for the abatement of NO_x in the UV region and we have correlated their surface area with the photo-activity (Figure 1). We have noticed a regular, but not linear, trend for the anatase prepared by wet method. This is connected with the presence of more disordered and even amorphous materials in the samples having the highest surface areas. A high specific activity has been observed for TiO₂ prepared by the flame method (Degussa P25, full points). This can be attributed to the presence of about 20% rutile, forming a highly active anatase-rutile interface.

Furthermore we have compared a pure titania to a C-doped TiO₂ with similar surface area under visible light irradiation; as we show in Figure 2, the NO oxidation using pure TiO₂ is much lower than that over C-doped TiO₂.

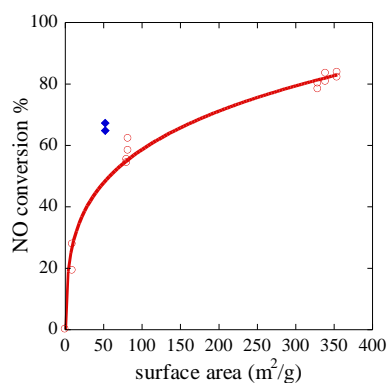


Figure 1 Correlation between activity and surface area of various anatase samples under UV irradiation

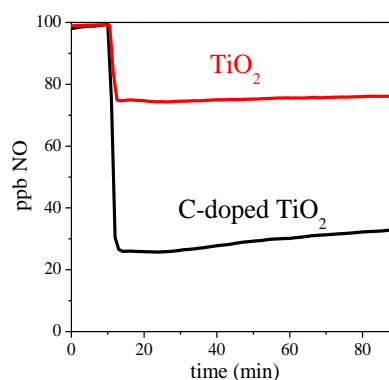


Figure 2 Visible-light photoactivity of C-doped TiO₂ and pure TiO₂

References

1. L.Cassar, *MRS Bulletin*, May 2004, p.1.
2. X.Yang, C.Cao, L.Erickson, K.Hohn, R.Maghirang, K.Klabunde, *J. Catal.* 260 (2008) 128.