CARBON DETERMINATION IN TITANIA PHOTOCATALYSTS

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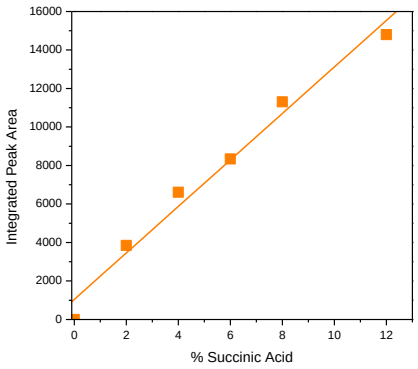
TiO_2 is the most used photocatalyst for solar energy conversion and environmental applications. Unfortunately, due to its large band gap (3.2eV), the light sources for photocatalytic reactions are limited to sunlight, which included only 2-3% ultraviolet rays. It's common knowledge that the introduction of transition metal ions such as V, W, Fe into the titanium oxide, or its modification with nonmetal atoms, (S, C , N), promotes the decrease of the bad gap energy[1].

Therefore, considerable efforts have been addressed to introduce a definite quantity of dopant in a appropriate amount (in the range 0.5-10%wt)[2]. Unfortunately, up to now, it was not possible to know in advance the effective percentage of dopant that remains in the phocatalysts after the synthesis.

In the present work we report a method that can be used to predict the final amount of carbon in TiO_2 samples. In particular, we found a correlation between the total organic compound used as a carbon precursor and the residual quantity of carbon in TiO_2 samples after thermal treatment. We underline by this approach the possibility to synthesize C-doped materials with a desired amount of modifing nonmetal atom

All samples were prepared using titanium oxysulfate as the TiO_2 precursor. Organic carbon compounds were introduced by thermal decomposition using succinic acid[3].

All catalysts were characterized by N_2 physisorption measurements, XRD, elementary analyses and temperature programmed oxidation measurements (TPO). N_2 physisorption analyses show that the surface areas of the new C-doped titania samples are significantly higher than the no-doped TiO_2. X-Ray diffraction revealed the presence of only the anatase crystal phase of titania. TPO analyses shows a close correlation between the peak area of oxygen consumed and either the total of carbon in the final catalysts or the amount of organic precursor used in preparation. Elementary analyses confirm these results.



The C-doped samples were tested in the photocatalytic abatement of NOx in the visible light region using a lab made plant equipped with a chemiluminescence analyzer. All doped samples have shown an activity in close correlation with the amount of carbon in the materials; in particular, an increase of the photocatalytic activity has been obtained for the samples doped with low carbon content.

Further improvements can be obtained through a careful optimization of the doping method.

References

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[2] Journal: G.Colòn, M.C.Hidalgo, M.Macìas, J.A. Navìo, *Appl.Catal. A: General*, 259 (2004) 235
[3] Patent: Orth-Gerber, Jurgen et al., *US 20050226761* (2005)