Poster

SYNTHESIS OF TITANIA BASED NANOTUBES AND ADSORBTION STUDY OF NO_2(g) ON THIS NANOSTRUCTURES

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Nanostructured materials have received a lot of attention because of their novel properties, which differ from those of the bulk materials. One-dimensional materials are an important category of nanostructured materials and have been widely researched yielding various special structures like nanotubes, nanorods, nanobelts and nanowires [1]. The materials in the nanotube form can be prepared from carbon, MoO_3, Al_2O_3, MoS_2, WS_3, ZrO_2 and NB, of which titania (TiO_2), is one of the most extensively researched materials.

Titania as a semiconductor, shows high photocatalitic activity and it is widely used as a catalyst and carrier of catalyst [2]. In addition, titania finds applications in the fileds of sensors, new type of solar cells, electrochromic devices, and antifogging and self-cleaning devices. The performance of titania in various applications depends on its dimensions, morphology and crystalline phase state. In recent years the materials has also been extensively studied as photocatalyst to deal with pollution, water purification, wastewater treatment, hazardous waste control, and air purification.

NO_2 is a primary component of NO_x gases, which are beside CO and SO_2 considered as greenhouse gases. As a very reactive gas NO_2 in the air reacts readily with common organic chemicals and even ozone, to form a wide variety of toxic products [3]. In view of that, we decided to investigate the adsorption properties of recently discovered TiO_2 based nanotubes toward NO_2.

Titania based nanotubes were prepared hydrothermally at 130^0 C via a reaction of anatase TiO_2 powder with a NaOH solution [4]. Figure 1 is a TEM image of as prepared TiO_2 based nanotubes. From the TEM image is evident that both, open and closed end nanotubes were obtained. Titania based nanotubes prepared in our process have a diameter between 10-20 nm and in length can reach up to 500 nm.

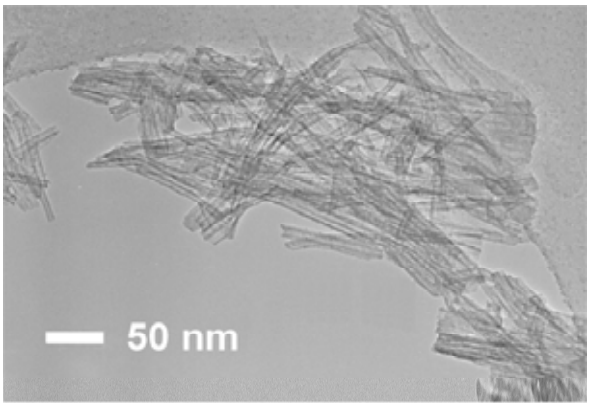

FIGURE 1. TEM image of TiO_2 based nanotubes. The estimated diameter of tubular nanostructures is found to be between 10 to 20 nm.

The specific surface area was studied by the BET technique. The specific surface area of TiO_2 based nanotubes increased by a factor of thirteen in comparison to anatase TiO_2 powder. In

particular in the sample that has been used in our EPR studies the specific surface area was around 130 m^2/g.

Nanotubes were also doped with some transition ions for which is predicted to increase the adsorption properties of titania based nanostructures.

A strong adsorption of NO_2 gas on the surface of TiO_2 nanotubes was observed with EPR. A comparison with BET analysis shows that a NO_2 monolayer is formed on the walls of TiO_2-based nanotubes. The EPR powder lineshape demonstrates that the adsorbed molecules are nearly static on the EPR lineshape timescale at very low temperatures. At higher temperatures thermally activated molecular reorientations determine the spin-lattice relaxation time T_1. An additional very broad powder EPR line has been observed with shoulders at g=2.09 and g=2.49 whose origin is at the moment not yet clear.

References:

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[2] R. Wang, K. Hashimoto, A. Fujishima, Nature 388 (1997) 431.
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[4] Q. Chen, W. Zhou, G. Du, and L. M. Peng, *Adv. Mater.* **14** (2002) 1208.