**Preparation of pod-shaped TiO2 and Ag@TiO2 nano burst tubes and their photocatalytic activity**

Shang Wang‡1, Zhaolian Han‡1, Tingting Di2, Rui Li1, Siyuan Liu1 and Zhiqiang Cheng\*1

1.College of Resources and Environment, Jilin Agricultural University, Changchun 130118, People’s Republic of China.

2.Northeast Electric Power Design Institue Co.,LTD. of China Power Engineering Consulting Group, Changchun 130021, People’s Republic of China.

\*Correspondence to: Zhiqiang Cheng (czq5974@163.com)

‡Shang Wang and Zhaolian Han contribute to the work equally.

C:\Users\Administrator\Desktop\不同温度降解图\不同温度降解图_画板 1.tifFig. S1 SEM image of calcination temperature of 350 °C (a), 550 °C (b), 750 °C (c) and photocatalytic activity of photocatalyst for photodegradation of RhB under ultraviolet light irradiation (d).

When the calcination temperature is 350 °C, Fig. S1(a) shows that only a small portion of the TiO2 nanotubes is cracked. The reason is that H2O and CO2 produced by the decomposition of H2C2O4 and PS are very slow at low temperature calcination. Therefore, the gas gently escapes from the surface of the TiO2 NBTs, resulting in TiO2 not being well cracked. However, when the temperature rises to 550 °C (Fig. S1(b)) and 750 °C (Fig. S1(c)), H2C2O4 and PS will rapidly decompose the H2O and CO2 gases generated. The impact of a large amount of gas will cause the surface of the TiO2 nanotube to crack and form a pod-shaped TiO2 NBTs. Therefore, there is almost no difference in the SEM pattern formed by calcination at 550 °C and 750 °C. The catalytic degradation experiments were carried out on three samples. The experimental results in Fig. S1(d) show that the degradation efficiency of the TiO2 NBTs calcined at 550 °C is 94.0%, while the degradation efficiency at 550 °C and 750 °C is 30.7. % and 20.1%.

C:\Users\Administrator\Desktop\附银的EDS\eds_画板 1.tifFig. S2 The EDX spectra of (a) TiO2(0.3%),(b) (0.01M)Ag@TiO2(0.3%), (c) (0.05M)Ag@TiO2(0.3%) and (d) (0.10M)Ag@TiO2(0.3%).

From the Fig. S2 we can observe the EDX spectrum of the TiO2 with different concentration of AgNO3. The peaks of the Ti, O and Ag are clearly observable and the atom percent was 74:24:0; 76:23:0.08; 74:25:0.12 and 70:24:0.22, respectively. Result of increasing concentration of AgNO3, the amount of deposited AgNPs on the surface of the Ag@TiO2 NBTs increased. This due to the higher concentration of AgNO3 solution causes more AgNPs to accumulate on the surface of the TiO2 NBTs, which leads to an increase in particle size, resulting in a decrease in the specific surface area of the particles and the surface active sites. Therefore, when the atomic percentage of the peaks of Ti, O and Ag is 74:25:0.12, the sample has the strongest catalytic ability.

C:\Users\Administrator\Desktop\1 回收样品电镜图-01.tifFig. S3 SEM image of pod-shaped TiO2(0.3%)(a-b) and (0.05M)Ag@TiO2 (0.3%)(c-d) NBTs before and after the catalytic experiment.

As shown in the SEM image of Fig. S3, the morphology of the pod-shaped TiO2(0.3%) NBTs (a) and (0.05M)Ag@TiO2(0.3%) NBTs (c) was clear before the catalytic experiment. The nanotubes is evenly connected. However, when the reaction was completed, the recovered pod-shaped TiO2(0.3%) NBTs (b) and (0.05M)Ag@TiO2(0.3%) NBTs (d) were subjected to scanning electron microscopy. The results showed that the structure of the catalyst after the reaction changed. The sample is transformed from a uniformly cracked nanoburst into a broken nanoburst. Therefore, the morphology of the nano burst tubes of pod-shaped TiO2(0.3%) changes with the degradation experiment.