

## Visible-Light Photocatalyst Sr and N Co-doped TiO<sub>2</sub> Synthesized by Liquid-Feed Flame Spray Pyrolysis

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### Introduction>

Semiconductor-based photocatalysis has attracted extensive interest after photoinduced decomposition of water on TiO<sub>2</sub> electrodes was discovered. For many years, most of the investigations have focused on TiO<sub>2</sub>, which shows relatively high reactivity and chemical stability under ultraviolet light. Recently, photocatalysts that show high reactivity under visible light have aroused considerable attention to improve energy efficiency of photocatalytic action. One approach has been to dope transition metals into TiO<sub>2</sub>, and another has been to form reduced TiOx photocatalysts. In my research, strontium as a cation and nitrogen as an anion doped TiO<sub>2</sub> was investigated for narrowing band gap, which is effective to absorb visible light.

### Experimental>

TiO<sub>2</sub> and Sr-doped TiO<sub>2</sub> (Sr-TiO<sub>2</sub>) were synthesized by liquid feed flame spray pyrolysis (LF-FSP). Titanatran and strontium propionate were dissolved in methanol. The precursor was combusted with methane/oxygen pilot torches in the combustion chamber. The organics were burned off and the resulting metal oxide powder is collected from the electrostatic precipitator (ESPs) for processing and characterization. TiO<sub>2</sub> and Sr-TiO<sub>2</sub> were N doped using a fluidized bed furnace. Synthesized particles in combustion gas had enough fluidity to prevent agglomeration and maintain high specific surface area (SSA).

### Characteristic and Originality>

Our research emphasizes the direct synthesis of single and mixed-metal oxide nano-powders by LF-FSP method.

### Results and discussions>

Mixture of anatase and rutile was observed in the N doped TiO<sub>2</sub> and Sr-TiO<sub>2</sub>.by XRD. The main component in the in the N doped TiO<sub>2</sub> and Sr-TiO<sub>2</sub> was anatase crystal. SSA of N doped TiO<sub>2</sub> particles synthesized by LF-FSP was higher than that of common TiO<sub>2</sub> particles. The highest SSA was observed for Sr doped TiO<sub>2</sub>. Moreover, the color of N doped TiO<sub>2</sub> and Sr-TiO<sub>2</sub> was changed corresponding to change in band gap hence absorbing visible light.

### References>

- [1] R. Asahi, T. Morikawa, T. Ohwaki, K. Aoki, Y. Taga (2001) Science, 293, 269-271
- [2] Y. Sakatani, H. Ando, K. Okusako, H. Koike, J. Nunoshige, T. Takata, J. N. Kondo, M. Hara, K. Domen (2004) J. Mater. Res., 19, 2100-2108
- [3] S. Kim, J. J. Gislason, R. W. Morton, X. Q. Pan, H. P. Sun, R. M. Laine (2004) Chem. Mater., 16, 2336-2343

### Keywords>

LF-FSP, Nano-powder, Photocatalyst, TiO<sub>2</sub>