

# Chlorine Induced In-Situ Growth of TiO<sub>2</sub>

## Nanoparticles on PVC Nano Fibers



Wei Peng<sup>1</sup>, Zihao Wo<sup>1</sup>, Chaofan Shi<sup>1</sup>, Hua Ma<sup>1</sup>, Yier Su<sup>1</sup>, Dongshan Zhou<sup>2\*</sup> and Xiwen Zhang<sup>1\*</sup>

1. School of Materials Science and Engineering, Zhejiang University, Hangzhou, 310027, China

2. Zhejiang YASHA Decoration Co., Ltd, Hangzhou, 310008, China

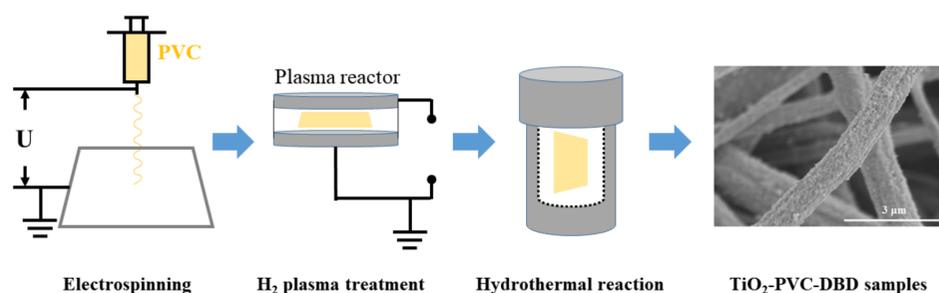
### Abstract

PVC-TiO<sub>2</sub>-DBD nanocomposites were synthesized via combined approaches of electrospinning, H<sub>2</sub> plasma treatment and hydrothermal reaction. The spinning solution composition and the amount of PVC were investigated and optimized in order to obtain membranes with uniform structure and high chemical activity. It was found that TiO<sub>2</sub> NPs were distributed homogeneously on the surface of the PVC fibers. Chemical bonds such as Ti-Cl and C-O-Ti bonds were formed to tightly immobilize the TiO<sub>2</sub> NPs on the PVC surface. The effect of H<sub>2</sub> plasma treatment on the surface of the PVC membranes was studied. Meanwhile, using ABS and PS as substrates, the influence of various groups, including chlorine bonds, C=C double bonds, cyano and phenyl groups on the possible promotion mechanism of different chemical bonds for the TiO<sub>2</sub> deposition was also studied. Possible mechanisms for the enhancement of the deposition of TiO<sub>2</sub> were given.

### Introduction

- Fabrics with deposited TiO<sub>2</sub> nanoparticles have drawn widespread attention in the self-cleaning, anti-bacterial and photocatalysis fields.
- Electrospinning is an ideal method to obtain fabrics, due to the fine flexibility, high porosity and large surface area to volume ratio.
- DBD plasma treatment is a “green” method of surface modification which can produce a large number of reactive chemical species on the surface at atmospheric pressure.

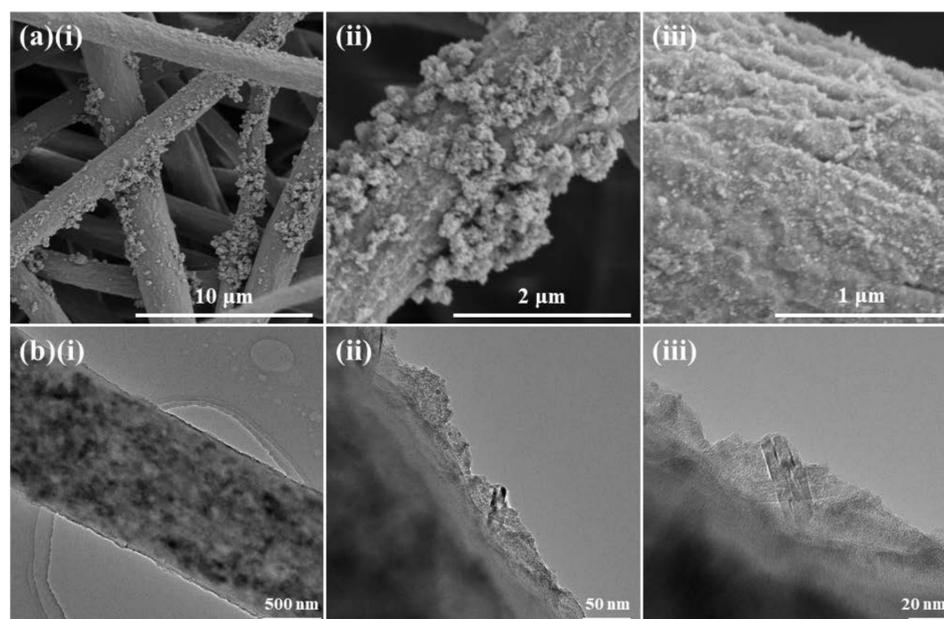
### Methods



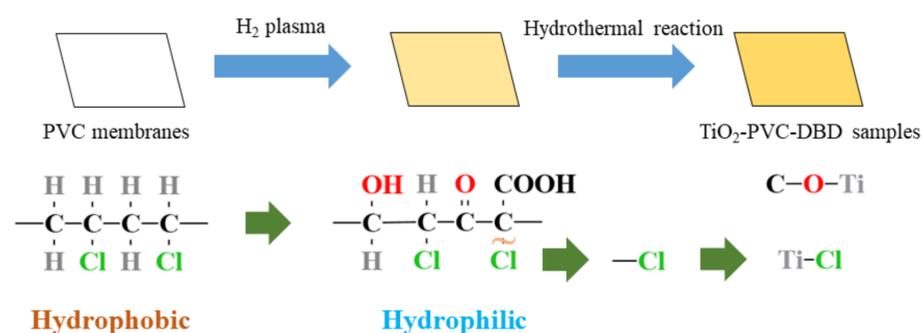
### Conclusions

- TiO<sub>2</sub>-PVC nanocomposites were fabricated via a combined strategy of electrospinning, H<sub>2</sub> plasma treatment and hydrothermal reaction.
- H<sub>2</sub> plasma treatment on PVC membranes has been proved to play a vital role in the deposition of TiO<sub>2</sub> NPs.
- The dechlorination reaction and the introduction of polar groups on the membranes improve the deposition of TiO<sub>2</sub> NPs.

### Results and Discussion



FESEM images and TEM images of the samples.



Enhancement mechanism of chlorine bonds promoting the deposition of TiO<sub>2</sub>.

### Acknowledgements

This work was financially supported by the National Natural Science Foundation of China (No. 50772098).