

## Supporting Information

# **Nickel-doped Excess Oxygen Defects Titanium Dioxide for Efficient Selective Photocatalytic Oxidation of Benzyl Alcohol under Visible Light Irradiation**

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## **Contents of the Supporting Information**

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### Synthesis of Ni-OTiO<sub>2</sub>(HF)

0.7 g TiO<sub>2</sub> precursor was added to 50 ml of ice water. After mixing, 30 ml of H<sub>2</sub>O<sub>2</sub> was slowly added and stirred for 1 h to obtain peroxy titanate. Then 8 ml of HF was added and stirred for 1 h. 0.029 g of C<sub>4</sub>H<sub>6</sub>NiO<sub>4</sub> was added to the mixed solution and heated to 50°C 2 h. It was dried and calcined in a muffle furnace at 300°C for 3 hours to obtain Ni-OTiO<sub>2</sub>(HF).

### Synthesis of Ni(1%)–OTiO<sub>2</sub>(400T)

0.029 g Ni(CH<sub>3</sub>COO)<sub>2</sub>·4H<sub>2</sub>O was added to the peroxy titanate and heated to 50°C for 2 h. The resulting yellow uniform gel was aged for 24 h and dried overnight. Finally, the resulting yellow solid material was placed in a muffle furnace at 400°C, with a heating rate of 10°C/ min for 3 h to obtain Ni(1%)–OTiO<sub>2</sub>(400T).

### Synthesis of Ni(1%)–OTiO<sub>2</sub>(500T)

0.029 g Ni(CH<sub>3</sub>COO)<sub>2</sub>·4H<sub>2</sub>O was added to the peroxy titanate and heated to 50°C for 2 h. The resulting yellow uniform gel was aged for 24 h and dried overnight. Finally, the resulting yellow solid material was placed in a muffle furnace at 500°C, with a heating rate of 10°C/ min for 3 h to obtain Ni(1%)–OTiO<sub>2</sub>(500T).

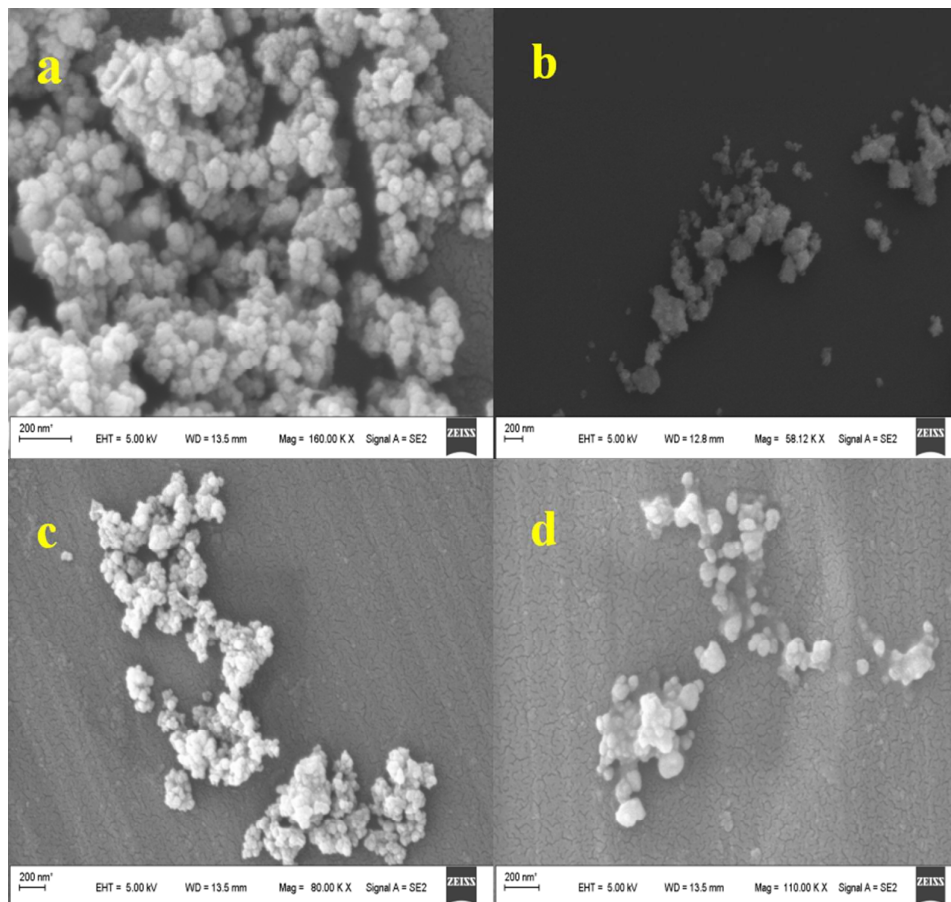


Fig. S1 (a) SEM image of TiO<sub>2</sub>; (b) SEM image of O<sub>2</sub>-TiO<sub>2</sub>; (c) SEM image of Ni(1%)-TiO<sub>2</sub>; (d) SEM image of Ni(1%)-OTiO<sub>2</sub>.

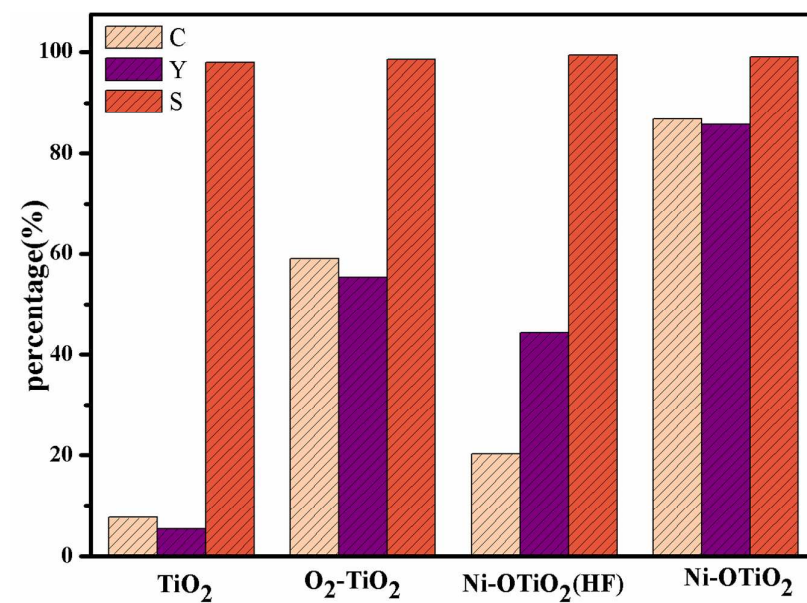


Fig.S2 Evaluation of photocatalytic (Ni-OTiO<sub>2</sub>(HF) ) activity

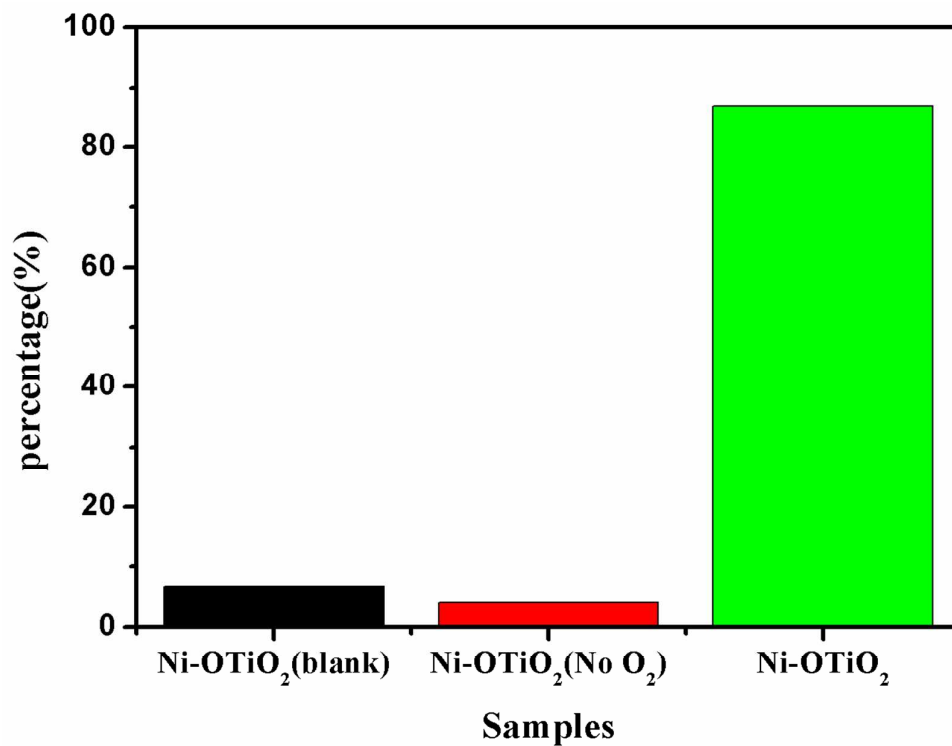


Fig.S3 Photocatalytic performance for selective oxidation of benzyl alcohol to benzaldehyde using the Ni(1%)-OTiO<sub>2</sub> samples under 300W Xenon lamp irradiation for 1 h with (1) NO Light; (2) NO O<sub>2</sub>; (3) light and O<sub>2</sub>.

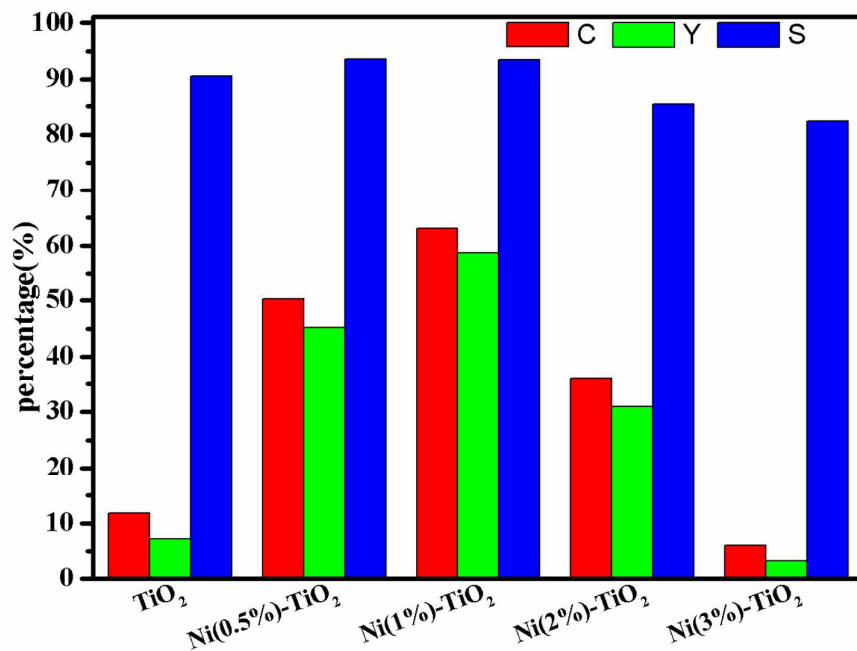


Fig.S4 Photocatalytic performance for selective oxidation of benzyl alcohol to benzaldehyde using (1) TiO<sub>2</sub>; (2) Ni(0.5%)-TiO<sub>2</sub>; (3) Ni(1%)-OTiO<sub>2</sub>; (4) Ni(2%)-TiO<sub>2</sub>; (5) Ni(3%)-TiO<sub>2</sub> samples as photocatalysts under 300W Xenon lamp irradiation for 1h;

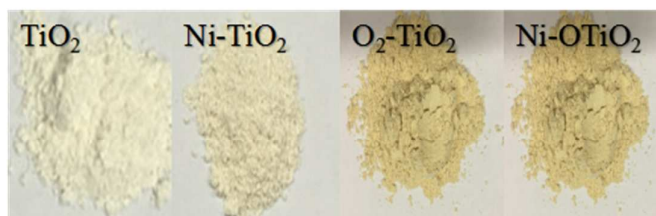
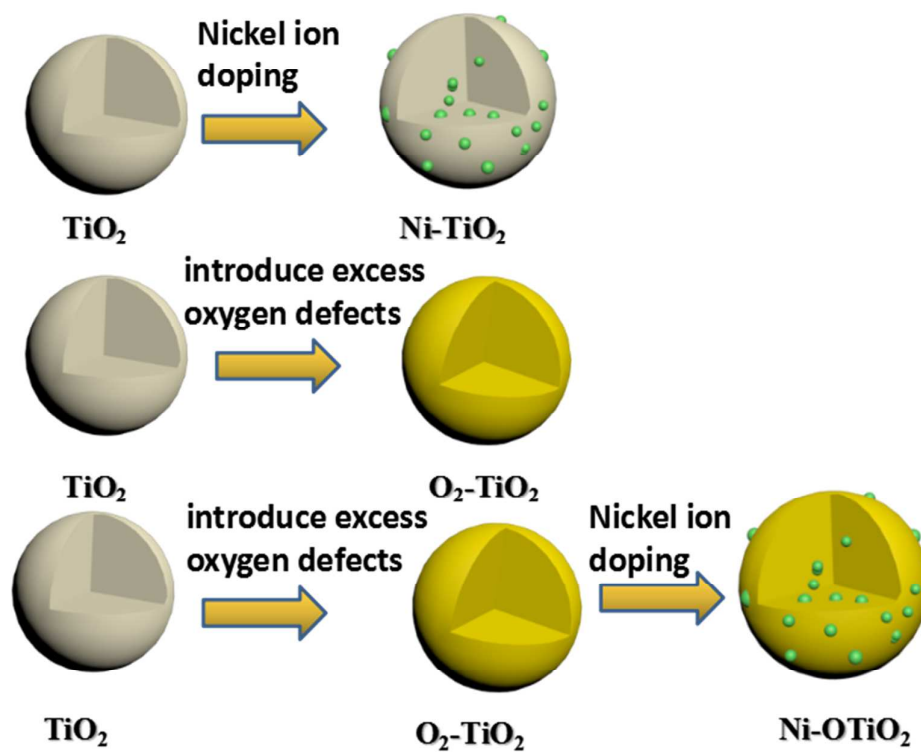


Fig.S5 photographs of the as-prepared solid samples.

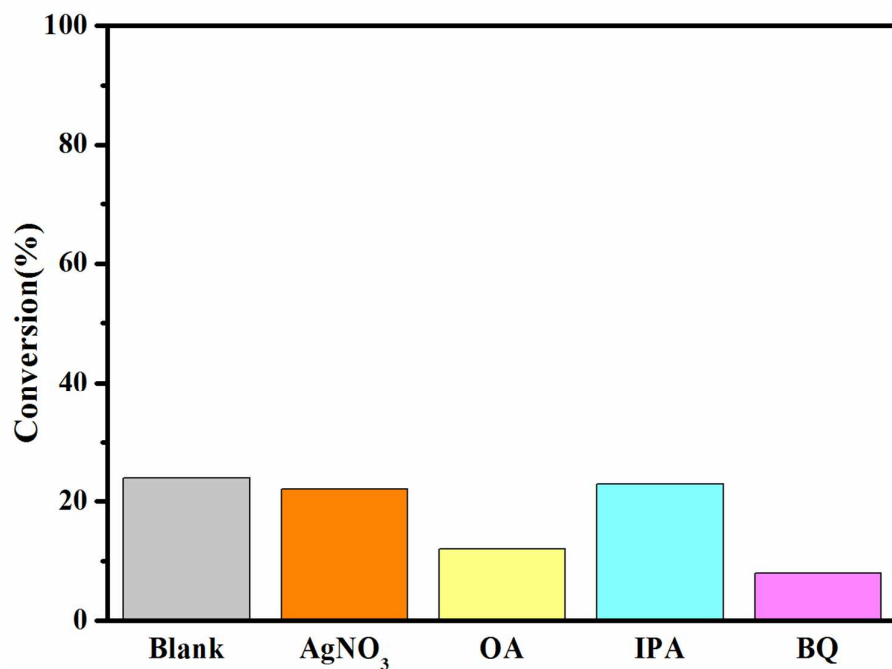


Fig.S6 Benzyl alcohol of conversion using Ni (1%)-OTiO<sub>2</sub> photocatalyst in the presence of different radical scavengers under irradiation for 1h.

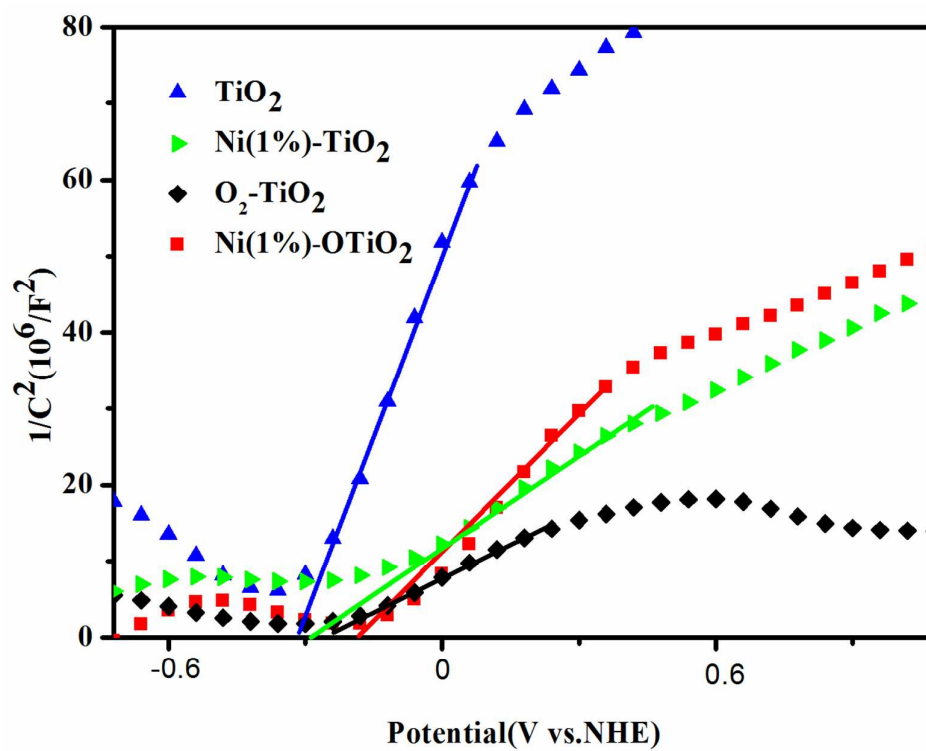


Fig. S7 Mott-schottky spectra of different samples.