

TiO₂-coated ZnO nanowire arrays: a photocatalyst with enhanced chemical corrosion resistance

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1. The cross-section view SEM of 5 nm TiO₂ coated ZnO NWs

The cross-section view SEM image of ZnO NWs + 5 nm TiO₂ has very similar behavior as ZnO NWs + 5 nm TiO₂, where the coating coefficient R of the 2 nm and 5 nm TiO₂ coated samples remains the same when scanning from top to bottom, which indicates the uniform coating from the top to the bottom.

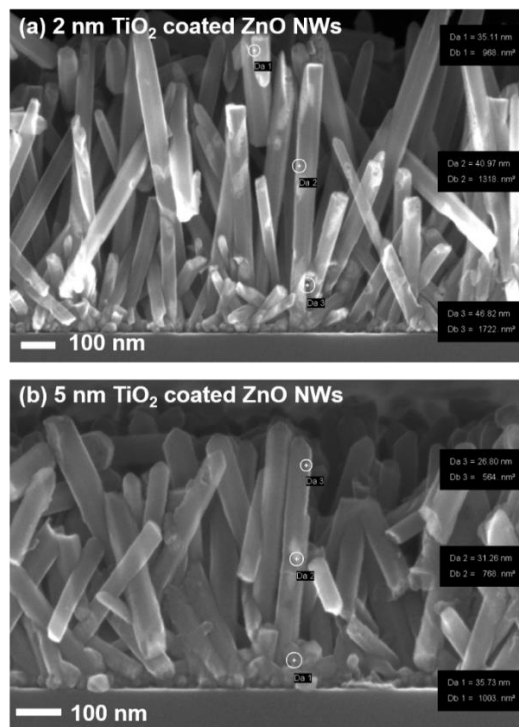
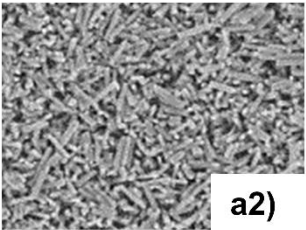
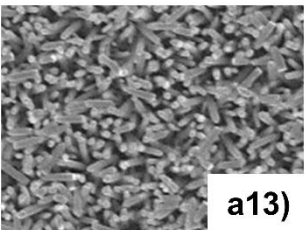
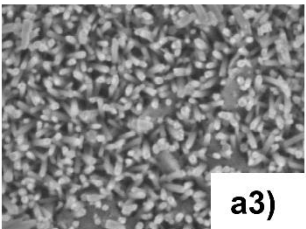
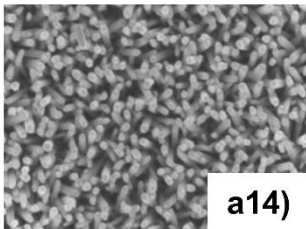
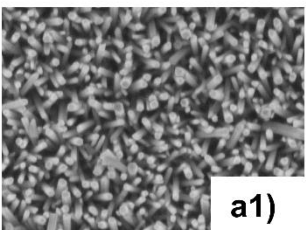
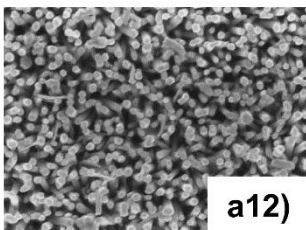
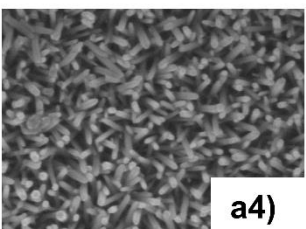
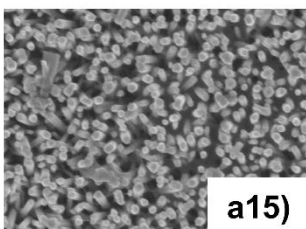
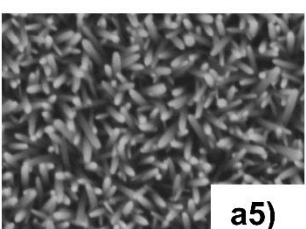
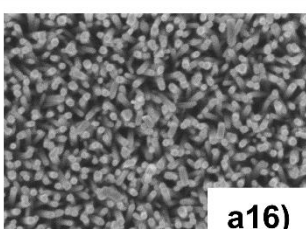


Figure S1: Cross section view SEM images of 2 nm (a) and 5 nm (b) TiO₂ coated ZnO NWs.

2. Effect of pH

To observe the effect of the pH aqueous solution on TiO₂-coated ZnO NWs and compare them with the original ZnO NWs samples, we also analyze the samples morphology after treated with acid and alkaline solutions which is shown in Figure S2. In the acid solution treatment test, serious damage can be observed by comparing samples a1, a2, and a3. The stronger the acidity of the test solution, the stronger the corrosion of bare ZnO NWs. For alkaline solution treatment, as the alkalinity of the solution increases, the bare ZnO nanowires become thinner where the ZnO can react with water and sodium hydroxide to form sodium zincate. On the contrary, the 10 nm TiO₂-coated ZnO NW sample shows an ideal protective effect on the nanostructures even after treated with pH 3 solution.

	ZnO NWs	ZnO NWs + 10 nm TiO ₂
pH3	 a2)	 a13)
pH5	 a3)	 a14)
No treatment	 a1)	 a12)
pH9	 a4)	 a15)
pH11	 a5)	 a16)

— 500 nm

Figure S2. Effect of pH aqueous solution on bare ZnO NWs and 10 nm TiO₂-coated ZnO NWs.

3. The photodegradation process of MB

The photodegradation process of MB was recorded by UV-Vis spectroscopy (Lambda 35, Perkin Elmer) every 15 minutes, and the maximum peak absorption of MB was 665 nm, which is represented by the red dashed line in Figure S3.

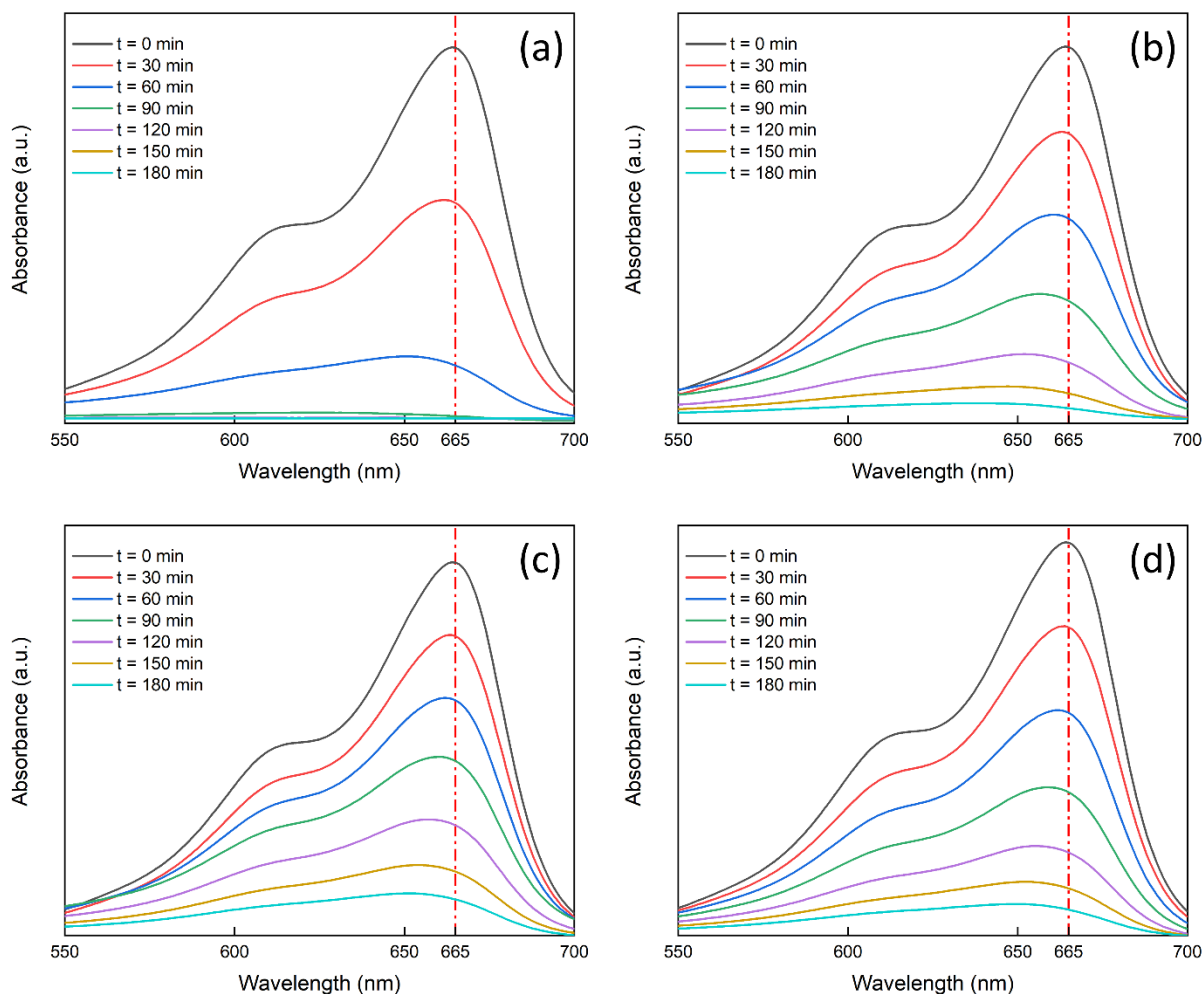


Figure S3. UV-Vis spectra recorded during MB photocatalysis degradation. a) Bare ZnO NWs, b) 2 nm, c) 5 nm, d) 10 nm TiO₂-coated ZnO NWs.

4. Band gap measurement results

The optical absorbance of the samples was measured through UV-Vis spectroscopy and the band gap was calculated through Tauc-Lorentz plot. All the samples were conducted for the band gap measurements, including ZnO NWs, 2 nm, 5 nm, 10 nm TiO₂ coated ZnO NWs sample. The results show that the band gap of the ZnO NWs, 2 nm and 5 nm TiO₂ coated ZnO NWs remains almost the same (which is around 3.18 eV), whereas the band gap of the 10 nm TiO₂ coated ZnO NWs is around 3.21 eV.

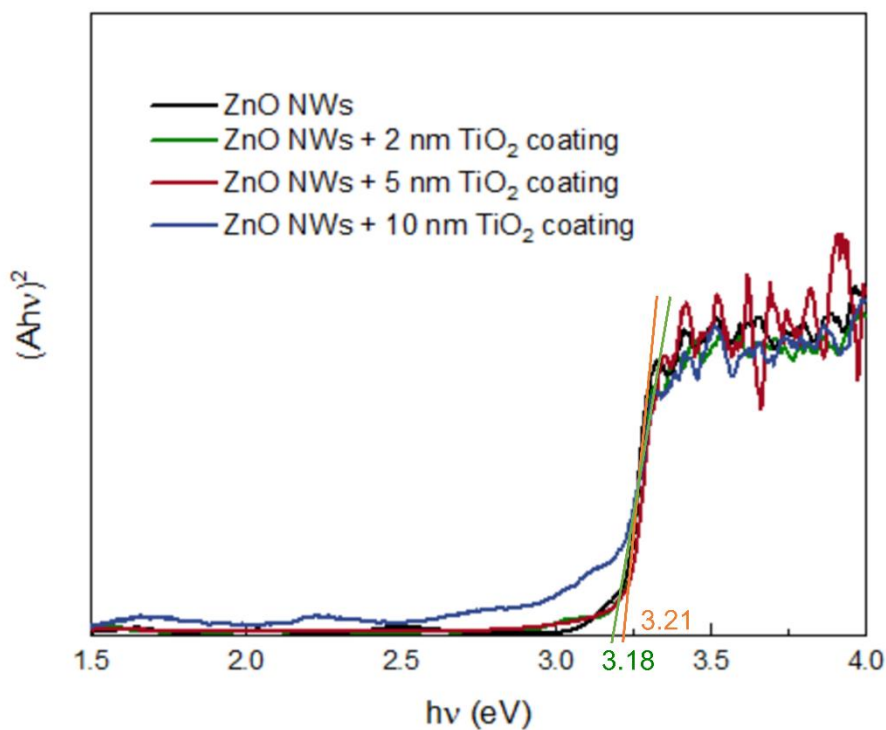


Figure S4. The Tauc-Lorentz plot of the ZnO NWs sample (black) and the 10 nm TiO₂ coated ZnO NWs (blue).

5. Photoluminescence (PL)

The presence of defects was highlighted by photoluminescence (PL) measurements using a spectrophotometer (Maya Pro 2000, Ocean Optics) and a He-Cd laser source (KIMMON, $\lambda = 325$ nm, P = 10 mW). Figure S5 showed the PL spectrum comparison before and after vacuum annealing at 500°C for four understudied samples. It is worth noting that the relative defect peak (in the visible region) is much larger after annealing than before annealing for each sample. Here, all PL measurements have been normalized with bandgap peak (in the UV region).

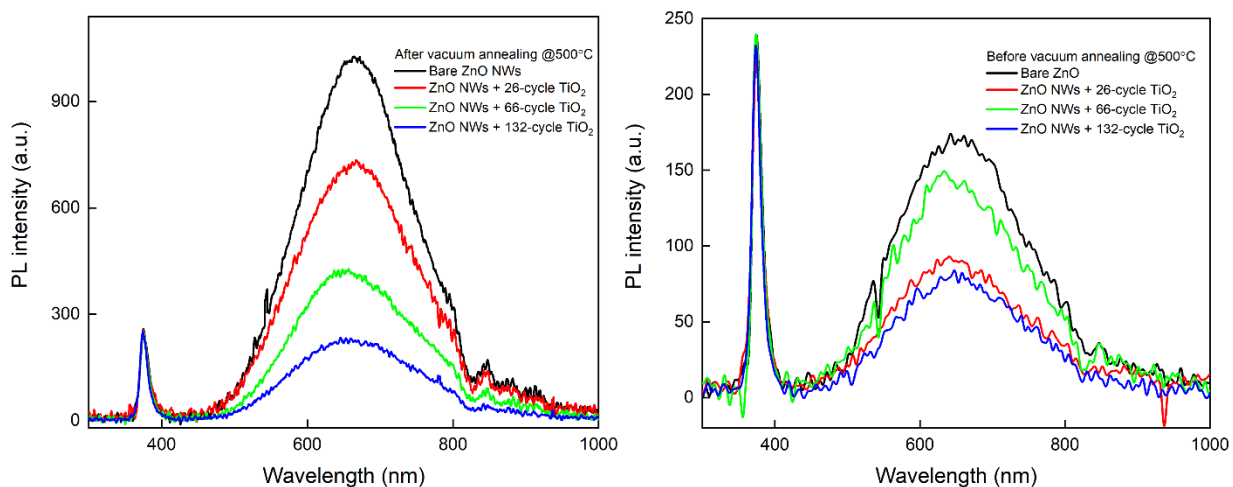


Figure S5. The photoluminescence spectrum comparison before and after vacuum annealing at 500°C.