Supporting information for

An *in-situ* solid-state heredity-restriction strategy to introduce oxygen defects into TiO_2 with enhanced photocatalytic performance

Jindou Hu, Wei Jia, Jing Xie, Yali Cao*, Xinhua Zhang, Dianzeng Jia*

Key Laboratory of Energy Materials Chemistry, Ministry of Education, Key Laboratory of Advanced Functional Materials, Autonomous Region, Institute of Applied Chemistry, Xinjiang University, Urumqi, Xinjiang 830046, China

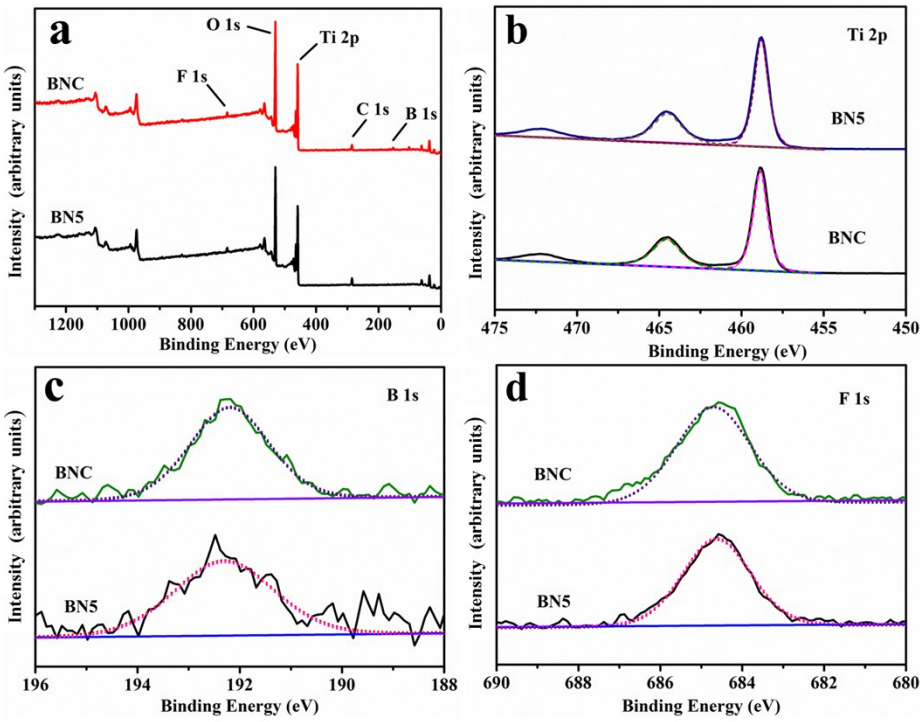

Fig. S1 the XPS spectrum of Ti 2p, B 1s and F1s in BN5 and BNC.

Fig. S1 is the XPS spectrum of Ti 2p, B 1s and F1s in BN5 and BNC. It can be seen in Fig. S1a that Ti, O, B, F and C elements were contained in both BN5 and BNC, the C element maybe come from the CO_2 of air. The peaks of Ti, B and F in BNC and BN5 all don't show an obvious difference in their XPS spectrum.

Tab. S1 the atomic percentage of the obtained samples BN5 and BNC.

Element	Atomic percentage from XPS (%)		Atomic percentage from EDX (%)	
	BN5	BNC	BN5	BNC
Ti	31.25	26.91	26.89	23.13
O	64.1	66.23	67.63	69.66
F	3.3	3.49	2.88	2.37
B	1.35	3.38	2.59	4.84

Tab. S2 the area percentage of the O 1s on BN5 and BNC.

	BN5		BNC	
	Area CPS (eV)	Area Ratio (%)	Area CPS (eV)	Area Ratio (%)
Lattice oxygen	117245	88.2	117383	77.7
Chemical oxygen	9737	7.3	18674	12.4
Adsorbed oxygen	5956	4.5	15027	9.9

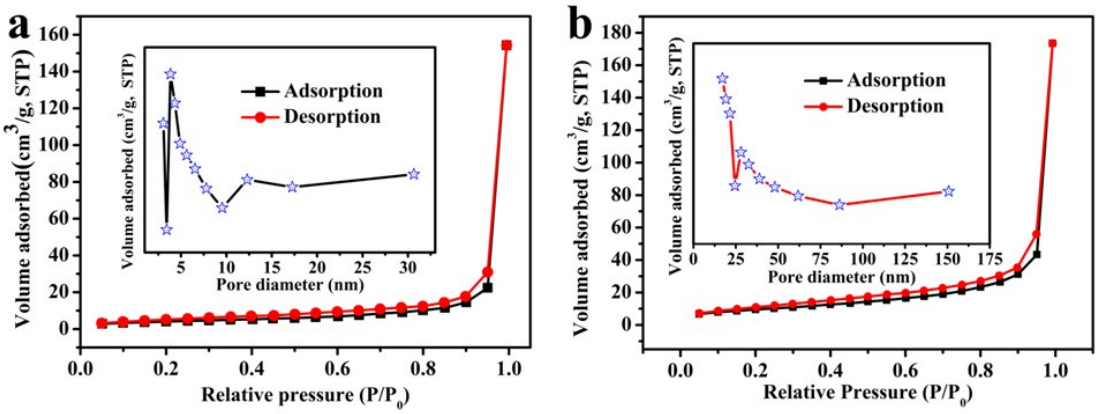

Fig. S2 the isothermal adsorption/desorption curve of BN5 and BNC (inset: the pore size distribution).

Tab. S3 the surface area of the as-obtained samples.

Samples	BN5	BNC
Surface area ($m^2 \cdot g^{-1}$)	14.846	34.295
Pore diameter (nm)	2.769	14.483
Pore volume ($cm^3 \cdot g^{-1}$)	0.044	0.080

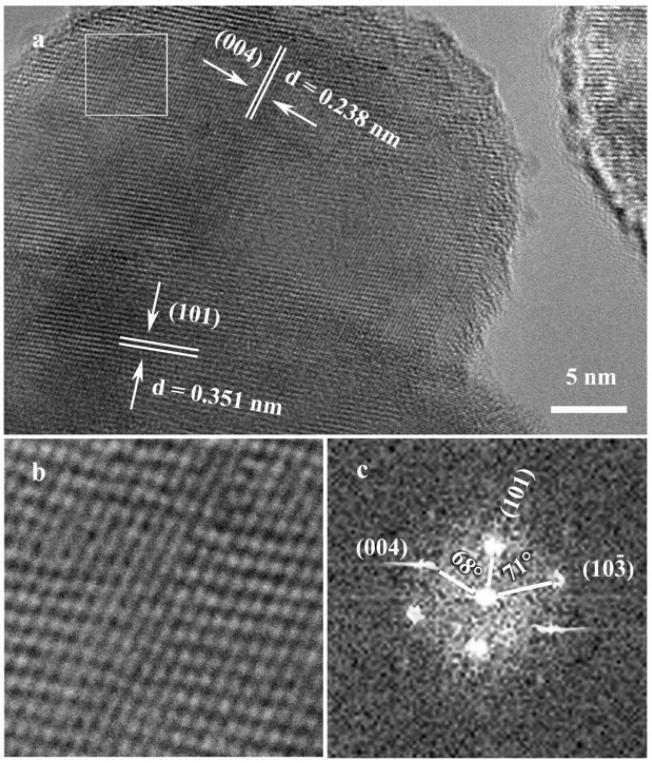

Fig. S3 the high-resolution TEM image (a, b) and the SAED images (c) of BNC.

Fig. S4 is the HRTEM of the obtained BNC. It can be seen from the marked parts of fig. S4c that the lattice fringes are discontinuous, the appeared intermittent lattice streaks indicates the existence of defects. The defects maybe caused by the introduced oxygen vacancies. 0.190 nm in fig. S4b is the lattice fringes spacing(100) face. Fig. S4d is the lattice fringes images obtained from the edge area of the nanoparticles. The amorphous regions in the marked places of fig. S4d may be caused

by defects or the incomplete growth of crystal.

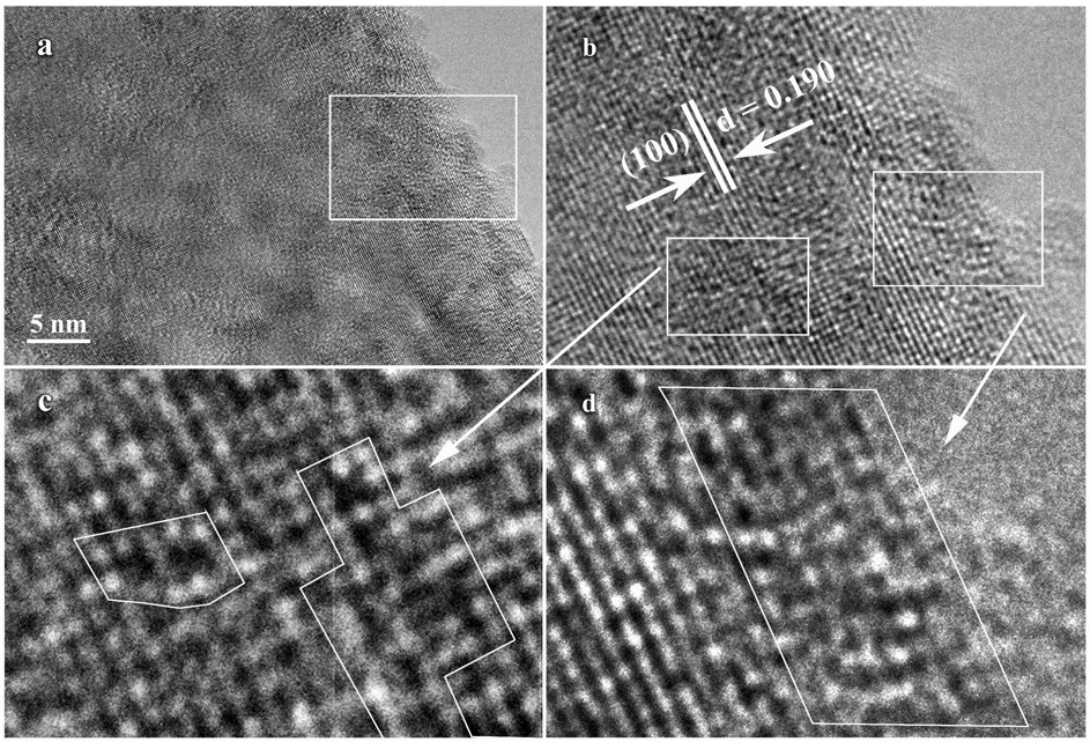

Fig. S4. The HRTEM images of sample BNC (a) and its magnification images (b-d)

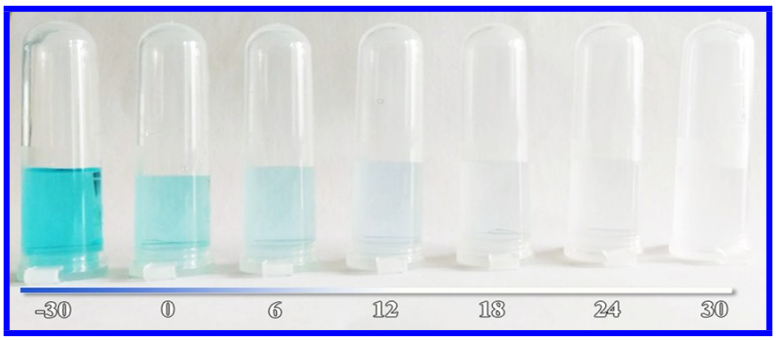

Fig. S5 the photographs of MB solutions for different photocatalytic reaction time of sample BNC after 15 months storage in air.

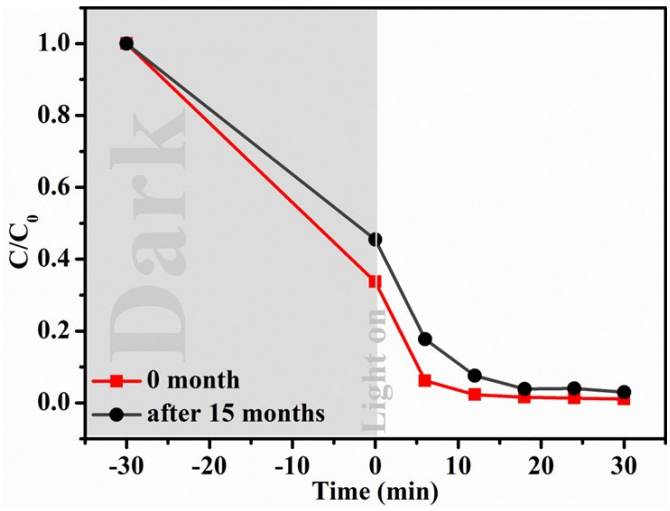

Fig. S6 the photocatalytic degradation of BNC before and after 15 months storage in air.