

As shown in Table S1, in the few published works on synthesis of C-TiO₂ by thermal oxidation of TiC [1-5], the optimal oxidation temperature and time were established at 350 °C for 8-100 hours to avoid complete replacement of carbon, rendering this time-consuming process less appealing. In addition, the relatively large particle size obtained in μm range has also reduced the academic interest in this approach. Therefore, the motivation of the current work is to simplify this synthesis approach by systematically studying the formation of C-TiO₂ with more aggressive process (at higher temperature of 400-600 °C with significantly reduced annealing time of 2 hours) in parallel with the conventional mild oxidation process (at 350 °C for 2-50 hours). Nano-sized TiC precursor was also used in an attempt to further reduce the particle size of the obtained C-TiO₂, for a larger BET surface area and thus higher photocatalytic efficiency.

Table S1 Preparation of C-TiO₂ by thermal oxidation of TiC in literature

References	Oxidation conditions	C-TiO ₂ size/phase information	Visible photocatalytic performance evaluation	light
[1]	350 °C for 36 hr in air followed by annealing at 600 °C for 5 hr under O ₂ flow	Anatase phase	Isopropanol decomposition	
[2,3]	350 °C for 5, 10, 50, and 100 hr, 400 °C for 20 hr, 600 °C for 4 hr and 800 °C for 2 hr in air	200-800 nm by SEM, anatase or anatase-rutile mixed phase	Methylene degradation	blue
[4]	200-400 °C for 4-16 hr in air	1 μm by SEM, anatase-rutile mixed phase	Trichloroacetic acid degradation	acid
[5]	350 °C for 50 hr in air followed by annealing at 400 °C for 10 hr in air	1-2 μm by SEM, anatase phase	Water photooxidation	

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 [3] Y. Choi, T. Umabayashi, M. Yoshikawa, *Journal of Materials Science* 39 (2004) 1837-1839.
 [4] M. Shen, Z. Wu, H. Huang, Y. Du, Z. Zou, P. Yang, *Materials Letters* 60 (2006) 693-697.
 [5] H. Liu, A. Imanishi, Y. Nakato, *The Journal of Physical Chemistry C* 111 (2007) 8603-8610.

The FTIR spectra in Fig. S1 indicated the appearance of Ti-O-Ti bond vibration at 553 cm^{-1} in the TiC precursor after exposure in air for 3 hours, signifying the native oxide formation. Further exposure in air up to 9 hours did not promote the further conversion from TiC to TiO_2 , suggesting that such conversion may appear only at the sample surface. Thus, in the XPS analysis, Ar sputtering was used to remove the possible presence of surface oxide on all the powder samples to unveil subsurface information for comparison with the surface composition.

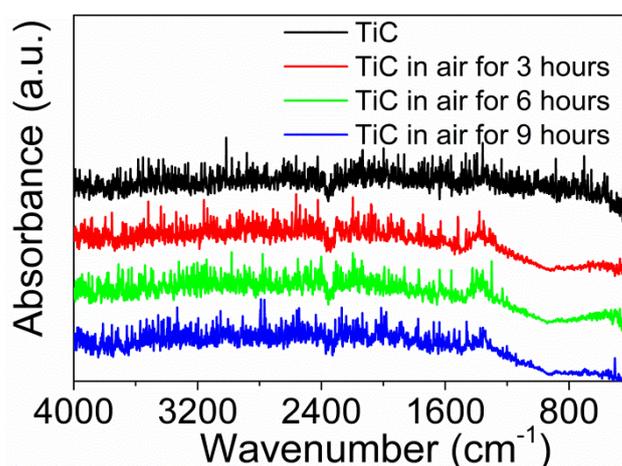


Fig. S1 FTIR absorption spectra for pristine TiC before and after exposure to air

XPS survey scan in Fig. S2 confirms that the main elements on the surface of all the samples are titanium, oxygen and carbon only. It is unlikely bonding such as C-F can be present in the analysis. The states of carbon in the C- TiO_2 can thus be primarily elucidated with XPS analysis in the range of 292-280 eV as shown in Fig. 9(b) in the manuscript.

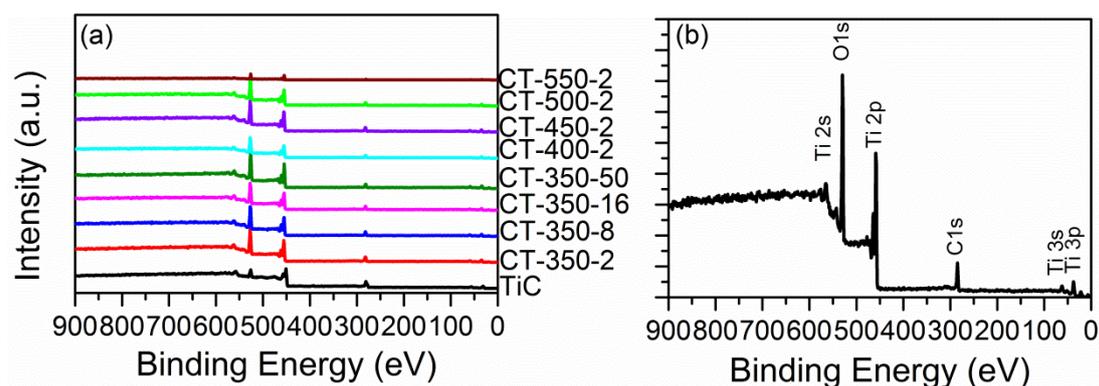


Fig. S2 XPS survey spectra for (a) all the samples and (b) CT-500-2