Supplementary information for:

Hierarchical rattle-like N-doped anatase TiO$_2$ superstructure: one-pot synthesis, morphological evolution and superior visible light photocatalytic activity

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Defination of the Kubelka-Munk function:

The diffuse reflection spectroscopy measurement can be converted into the equivalent absorption coefficient by applying the transformation based on the Kubelka-Munk function,which was defined as:

$$F(R_\infty) = \frac{K(\lambda)}{S(\lambda)} = \frac{(1-R_\infty)^2}{2R_\infty}$$

Where K, and S are the absorption and scattering coefficients, respectively. R is the reflectance. The optical band gaps of the semiconductors were evaluated based on the following expression[1-2]:

$$(ah\nu)^{1/n} = B(h\nu - E_{bg})$$

Where α is the absorption coefficient, hν is the incident photon energy, E$_{bg}$ is the band gap energy, and B is a constant related to the effective masses of charge carriers associated with valance and conduction bands. The value of n depends on the type of interband transition: n = 2 for a direct transition, while n = 1/2 for an indirect transition. The adsorption coefficient is plotted against (hν - E$_{bg}$).
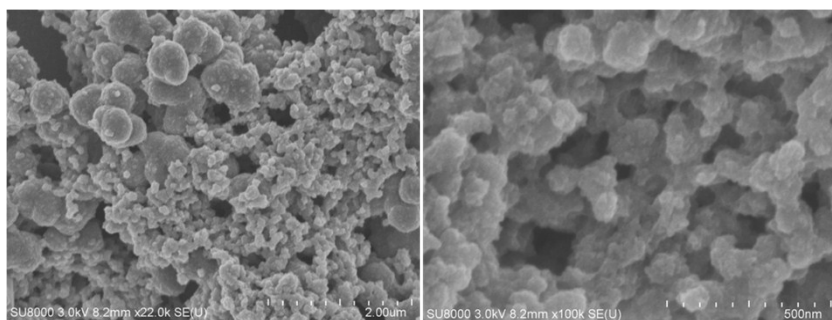
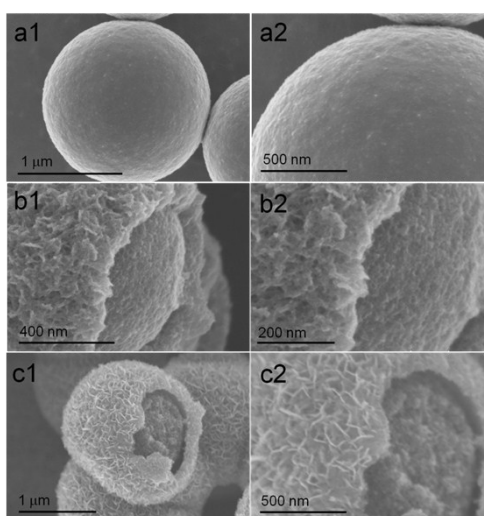Fig. S1 SEM images of the primary products under ultrasonication treatment.

Fig. S2 HRSEM images of the samples prepared for different solvothermal reaction time. Note: a, b, and c are typical HRSEM images for samples obtained at 6 ($NDRT_6$), 12 ($NDRT_{12}$), and 24 ($NDRT_{24}$) hours, respectively.
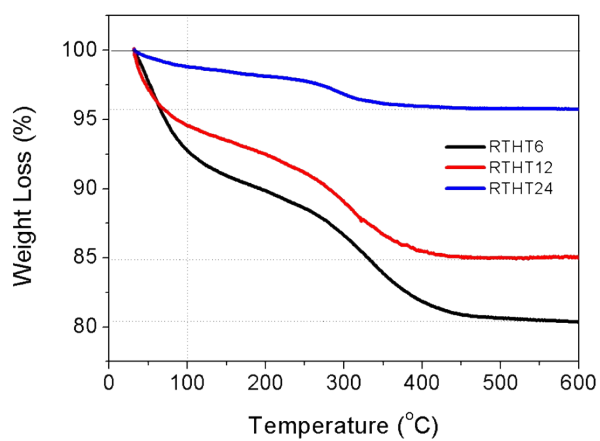

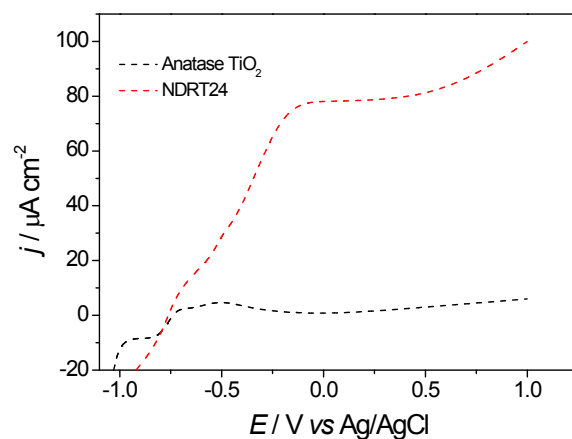Fig. S3 TG curves for $NDRT_6$, $NDRT_{12}$, and $NDRT_{24}$.

Fig. S4 Voltammograms of the as-prepared NDRT$_{24}$ and the comparison anatase TiO$_2$ under visible light (λ > 420 nm) illumination.
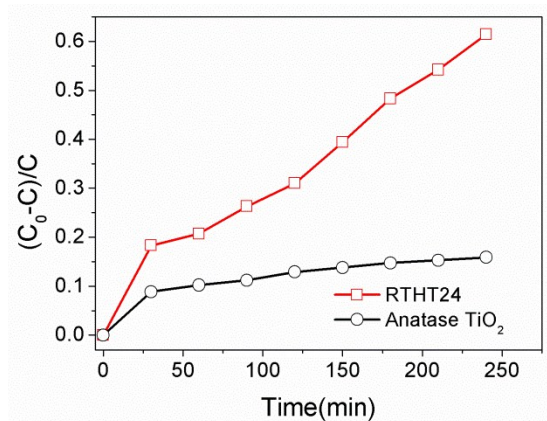

Fig. S5 Removal effeciency of formic acid by the prepared RTHT$_{24}$ and the commercial anatase TiO$_2$ under visible light irradiation.

Reference:

1   A. Petala, D. Tsikritzis, M. Kollia, S. Ladas, S. Kennou and D. I. Kondarides, *Appl. Surf. Sci.* 2014, **305**, 281.

2   H. Kisch, *Angew. Chem.- Int. Edit.* 2013, **52**, 812.