Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Light-Controlled Propulsion, Aggregation and Separation of Water-Fuelled TiO_2/Pt Janus Submicromotors and Their "on-the-fly" Photocatalytic Activities

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Supporting Figures

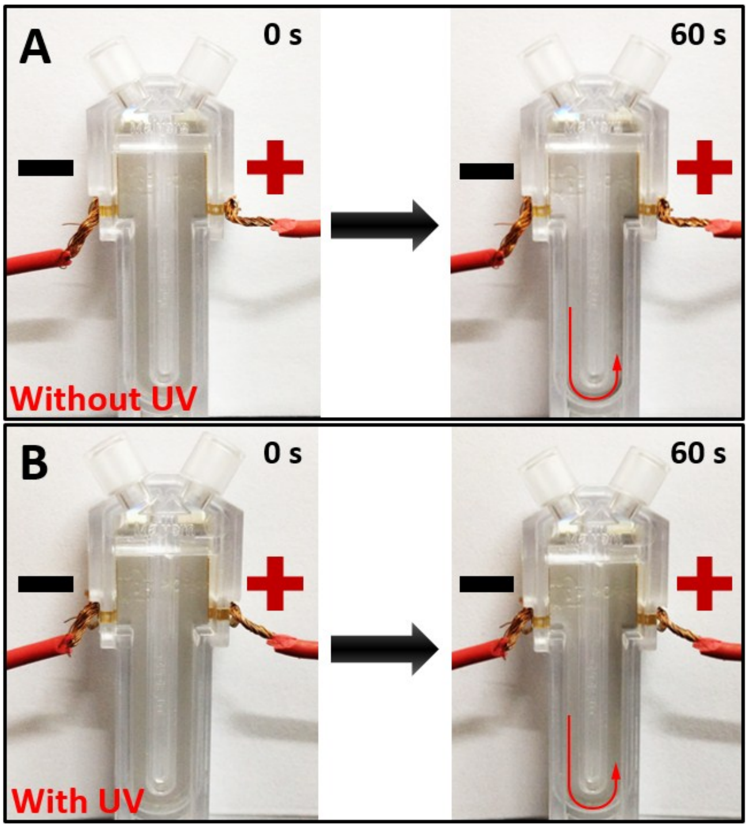

Figure S1. The electrophretic mobility of the TiO_2/Pt Janus submicromotors in water under an electric field of 500 V (A) without or (B) with UV irradiation (1W cm^{-2}). The increasing color contrast between two electrodes reveals that the TiO_2/Pt Janus submicromotors exhibit a net negative charge with or without UV irradiation. Red arrows in the figures represent the motion direction of the TiO_2/Pt Janus submicromotors.

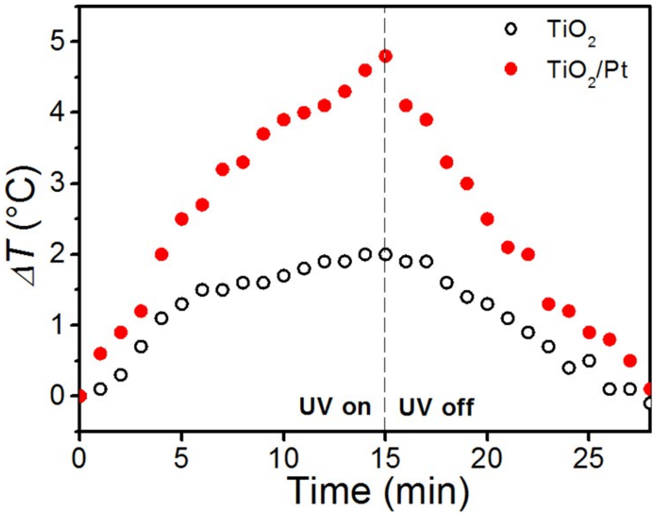

Figure S2. The temperature change (ΔT) of water containing TiO_2 and TiO_2/Pt particles (0.2 mg mL^{-1}) response to UV (368 nm, 1 W cm^{-2}) on and off for different times.

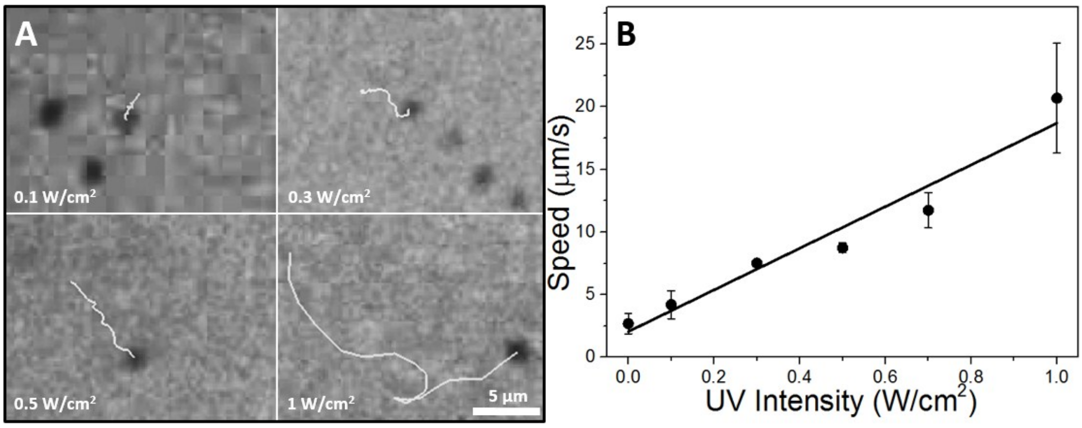

Figure S3. (A) The propulsion and trajectories (white curves) of the TiO2/Pt submicromotors under UV irradiation in 1 s with different UV intensity: 0.1, 0.3, 0.5 and 1W cm^{-2}; (B) Speed of the TiO2/Pt Janus submicromotors *versus* UV intensity.

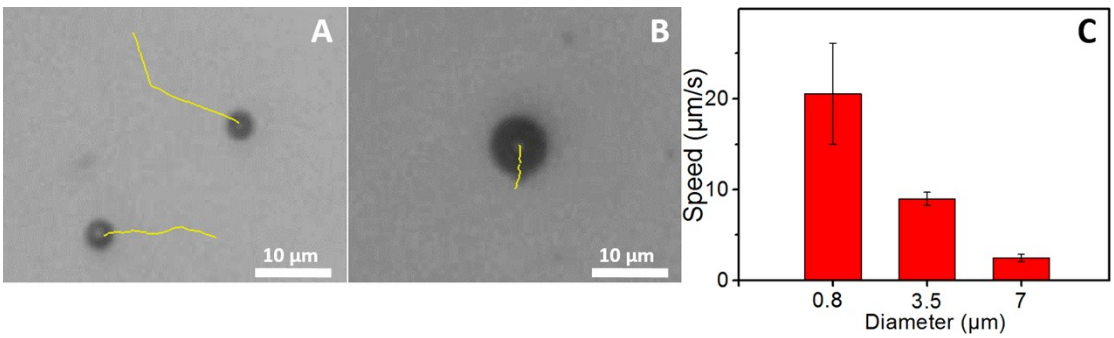

Figure S4. Trajectories of TiO_2/Pt micromotors with diameters of (A) 3.5 and (B) 7 µm in water under UV irradiation within a period of 2 s. (C) Speed of the TiO2/Pt Janus micromotors *versus* diameters.

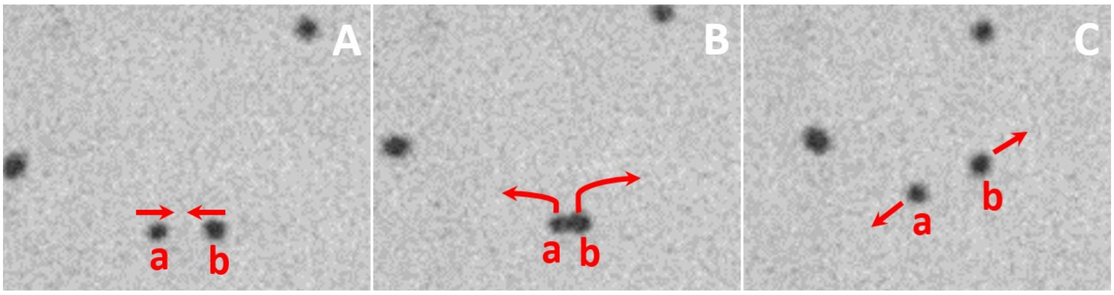

Figure S5. The (A) approach, (B) collision and (C) separation of two TiO_2/Pt Janus submicromotors at different time intervals: (A) 0, (B) 0.2 and (C) 0.6 s, respectively.

Calculation of the Electrostatic Force

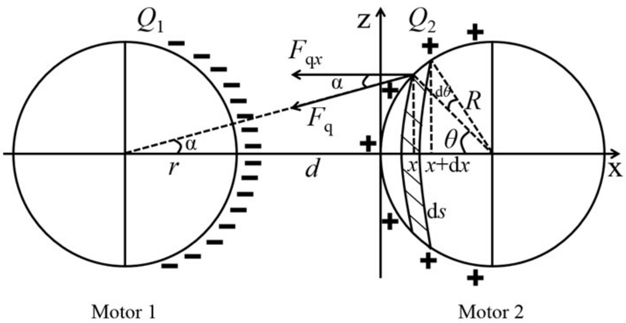

Figure S6. Electrostatic interaction between two TiO_2/Pt Janus submicromotors.

In Figure S6, Motor 1 and 2 with the radius of *r* and *R* represent two approaching TiO_2/Pt Janus submicromotors with asymmetric surface charges Q_1 and Q_2, respectively. We assume that the charges Q_1 and Q_2 are equally spread on the surfaces of Motor 1 and 2. Electrostatic force exerted on Motor 2 in the electric field (E_{Q1}) produced by Motor 1can be described as the superposition of all the infinite number of charged circular global belt with surface area of d*s*:

$$ds = 2\pi R^2 \sin\theta d\theta$$

as,

$$Rd\theta = \frac{dx}{\sin\theta}$$

So,

$ds = 2\pi R dx$Hence, the charges (q) on the circular global belt is,

$$q = \frac{Q_2}{2\pi R^2} 2\pi R dx = \frac{Q_2}{R} dx$$

and the electrostatic force (F_{qx}) on the circular global belt is,

$$F_{qx} = F_q \cos\alpha = E_{Q_1} q \cos\alpha = \frac{r+d+x}{\sqrt{(r+d+x)^2 + 2Rx - x^2}} E_{Q_1} \frac{Q_2}{R} dx$$

As,

$$E_{Q_1} = \frac{Q_1}{4\pi\varepsilon_0\left[(r+d+x)^2 + 2Rx - x^2\right]}$$

The net electrostatic force (*F*) on Motor 2 can be calculated as follow,

$$F = \sum F_{qx} = \int_0^R \frac{Q_1 Q_2 (r+d+x)}{4\pi\varepsilon_0 R\left[(r+d+x)^2 + 2Rx - x^2\right]^{\frac{3}{2}}} dx = \frac{Q_1 Q_2}{4\pi\varepsilon_0 R (r+d+R)^2}\Big[R +$$