Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

1. X-ray diffraction patterns of PANI

The powder X-ray diffraction patterns (PXRD) were performed on a Rigaku SmartLab 9kW ray diffractometer at room temperature, in paralle beam geometry employing Cu Kα lines focused radiation (1.54059 Å, 1.54439 Å) at 9kW (45Kv, 200mA) power.

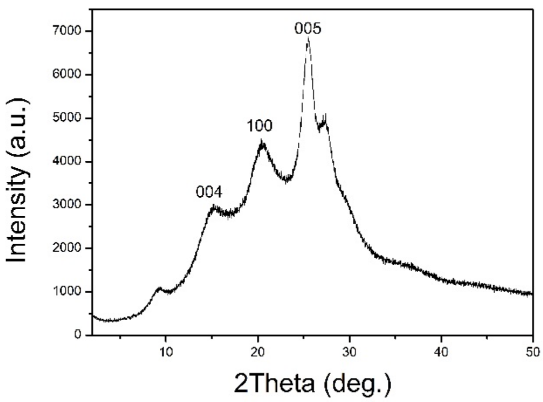

Fig. S1 X-ray diffraction patterns of PANI

2. Calculation of the estimated crystal size of PANI/Ag by Scherrer equation

The relation between grain size and half-peak width of XRD peaks is given by Scherrer equation:

$$d=K\lambda/ (B\cos\theta)$$

In the equation, λ is the wavelength (λ=1.54060 Å for Cu Kα1), θ is the diffraction angle, B is the width at half height of the peak around θ, K is the correction factor (K=0.89). The size of every crystal face, as calculated according to benchmark of standard silver peaks, was 67.2, 58.1, 57.5, and 54.4 nm, respectively. And the average crystal size is 59.3nm, which is consistent with the result of TEM image (Fig.4 (e) (f)).

3. **Particle size distribution of PANI micro-spheres and PANI micro-rods**

The particle size distribution of PANI with different morphology is illustrated in Fig.4, which suggests that the PANI particles are normally distributed of a few microns, consistent with the SEM images of PANI particles.

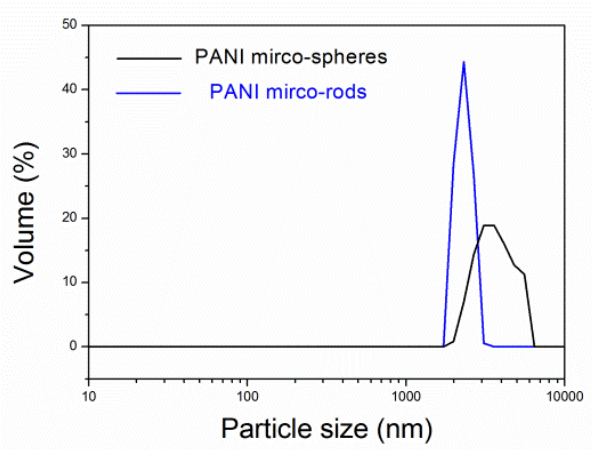

Fig. S2. Particle size distribution of PANI micro-spheres and PANI micro-rods

4. **The derivation process of rate constant**

For the initial concentration of $NaBH_4$ greatly exceeded that of 4-nitrophenol, so it was assumed that the concentration of $NaBH_4$ remained constant during the reaction. In other words, the reduction of 4-nitrophenol can be considered as pseudo-first-order reaction. So, there exists a linear correlation between $\ln(A_t)$ and the reaction time, which is shown in Fig.7. $\ln(A_t)$ represents the natural logarithm of absorption value at a time. The reaction rate follows first order kinetics, which can be illustrated in Eq. (1)

$$-\frac{dc}{dt} = kc \quad (1)$$

The apparent rate constant in the reduction of 4-nitrophenol was calculated by the following equations:

$$\frac{-dc}{c} = kt \tag{2}$$

$$-\int_{c_0}^{c_t} \frac{dc}{c} = \int_0^t kdt \tag{3}$$

$$-ln\left(\frac{c_t}{c_0}\right) = kt \tag{4}$$

Under a certain wavelength

$$A = ac \tag{5}$$

$$k = \frac{ln(A_0/A_t)}{t} = \frac{(lnA_0 - lnA_t)}{t} \tag{6}$$

Where t represents time, k represents the apparent rate constant, c_0 represents the initial concentration of 4-nitrophenol, c_t represents the concentration of 4-nitrophenol, which changes over time, A_0 is the initial absorbance of 4-nitrophenol, A is the absorbance of 4-nitrophenol, which changes over time, a is the proportionality constant.