

## Supporting Information

### Formation of Uniform Mesoporous $\text{TiO}_2@\text{C-Ni}$ Hollow Hybrid Composites

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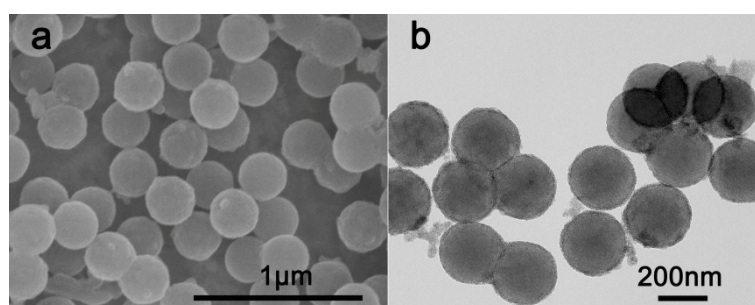


Fig. S1 SEM and TEM images of the CPS@TiO<sub>2</sub> nanospheres.

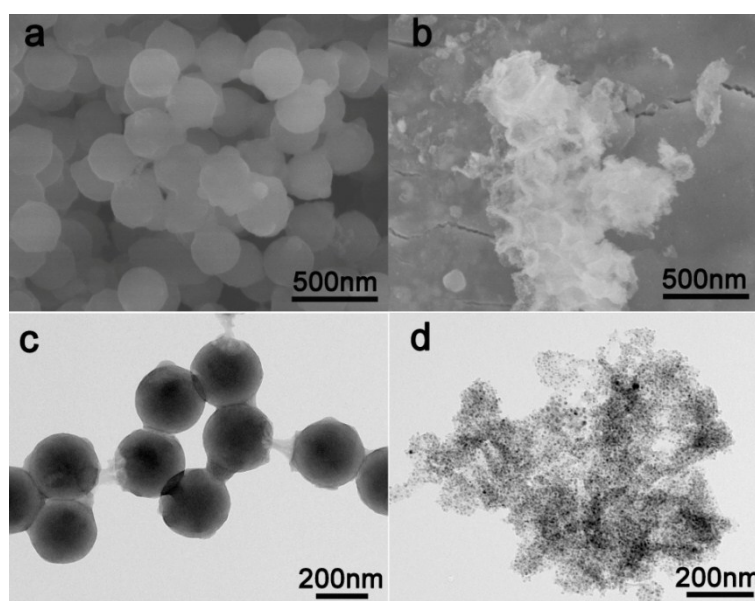


Fig. S2 (a, b) SEM and (c, d) TEM images of the CPS@PDA-Ni<sup>2+</sup> and C-Ni nanospheres.

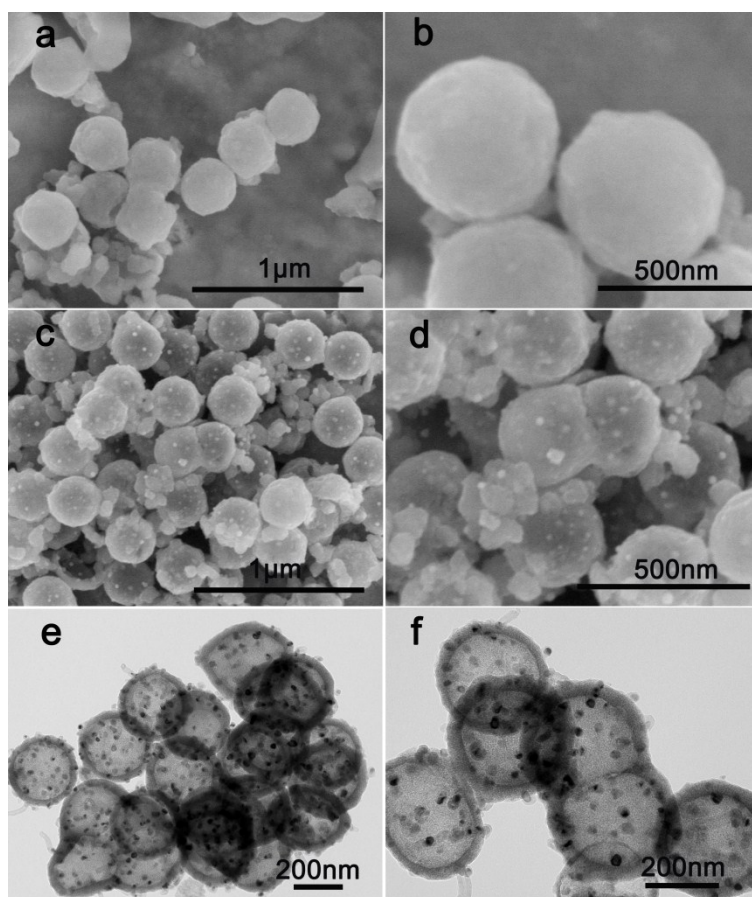


Fig. S3 SEM image of the CPS@TiO<sub>2</sub>@PDA-Ni<sup>2+</sup> nanospheres (a, b), SEM(c, d) and TEM images (e, f) of the hollow TiO<sub>2</sub>@C-Ni nanospheres.

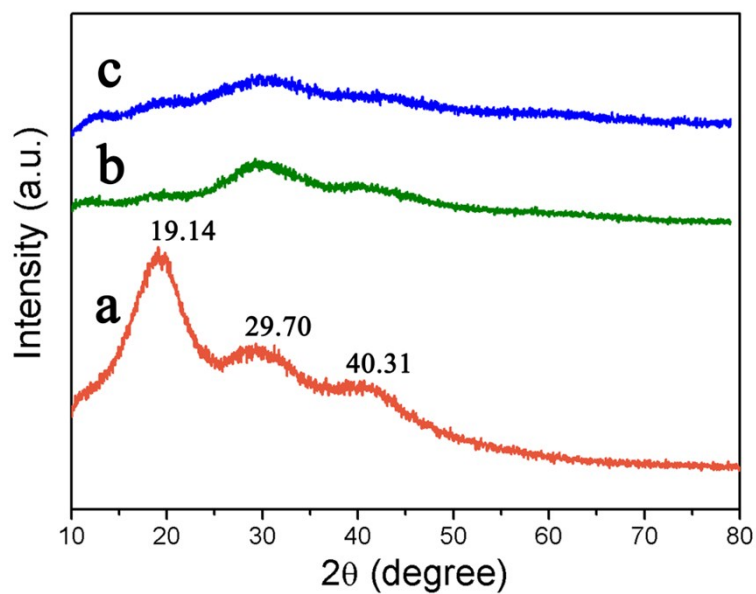


Fig. S4 XRD diffraction patterns of CPS(a); CPS@mTiO<sub>2</sub> (b) and CPS@mTiO<sub>2</sub>@PDA-Ni<sup>2+</sup> (c).

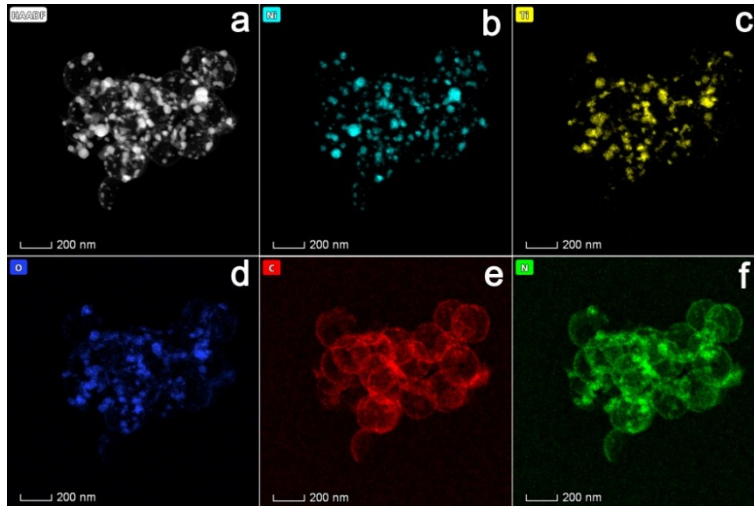


Fig. S5 (a) STEM image of mTiO<sub>2</sub>@C-Ni/700 and corresponding elemental mappings of (b) Ni, (c)Ti, (d) O, (e) C and (f) N.

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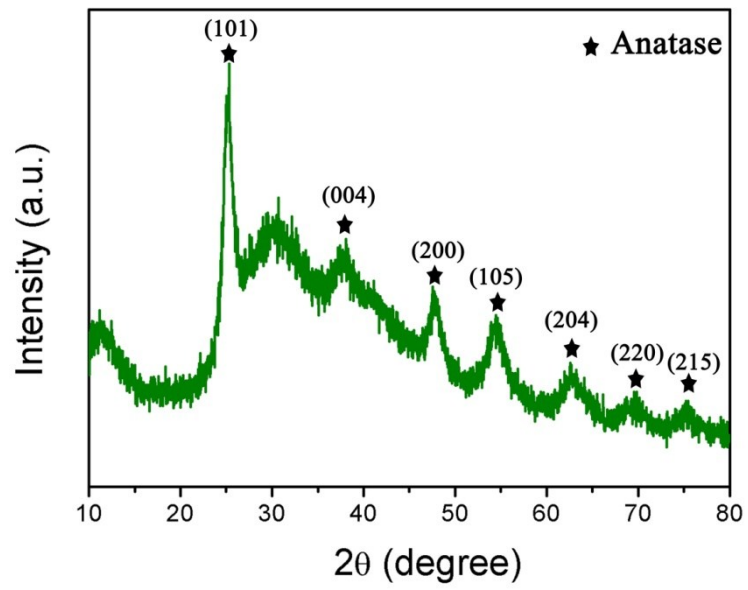


Fig. S6 XRD diffraction patterns of hollow mTiO<sub>2</sub> spheres

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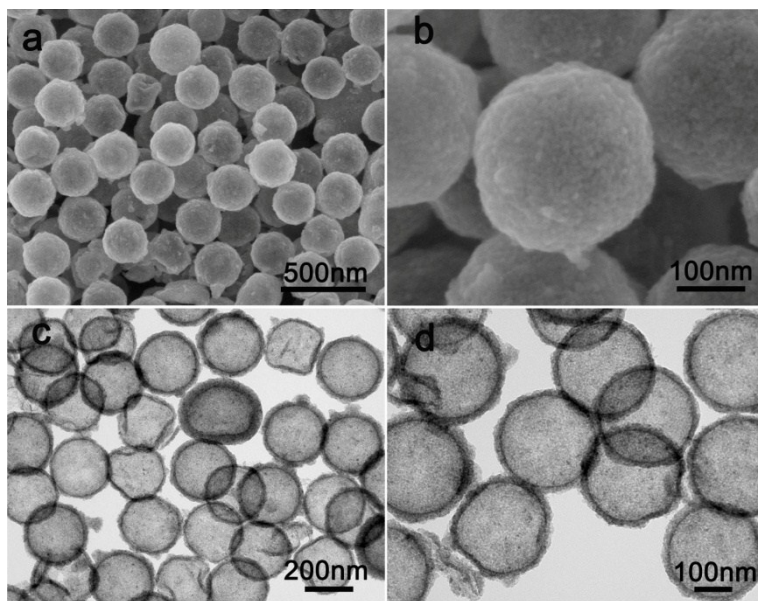


Fig. S7 (a, b) SEM and (c, d) TEM images of the hollow mTiO<sub>2</sub> nanospheres

**Table S1.** A full comparison of the activity parameter  $\kappa$  of mTiO<sub>2</sub>@C-Ni/700 hollow hybrid composites with other noble metal and no-noble catalysts

| Catalyst   | $K(\times 10^{-3}\text{s}^{-1})$ | $k(\times 10^{-3}\text{mg}^{-1}\text{s}^{-1})$ | References |
|--|----------------------------------|--|------------|
| TiO <sub>2</sub> @C-Ni/700   | 15.17                            | 173.21   | This work  |
| Cu nanoplate   | 9.5                              | 136  | 1          |
| SiO <sub>2</sub> @C-Ni   | 5.2                              | 37   | 2          |
| Fe <sub>3</sub> O <sub>4</sub> @SiO <sub>2</sub> -Au@mSiO <sub>2</sub> | 7                                | 105  | 3          |
| Ag/Cu  | 6.70                             | 74   | 4          |
| AuPd   | 5.2                              | 74   | 5          |
| Au@meso-SiO <sub>2</sub>   | 1.33                             | 41.8   | 6          |
| PtPdBi   | 4.3                              | 287  | 7          |
| Fe@Au-ATPGO  | 1.4                              | 400  | 8          |

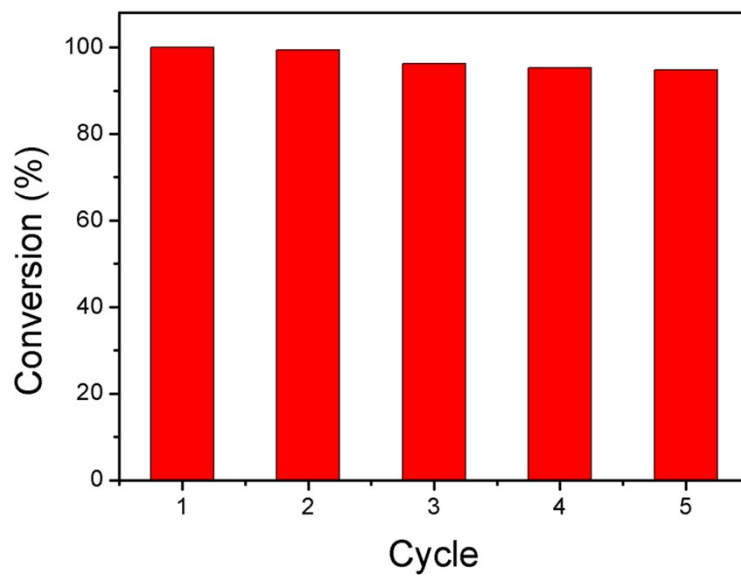


Fig. S8 The reusability of  $mTiO_2@C-Ni/700$  as the catalyst for the reduction of 4-NP with  $NaBH_4$

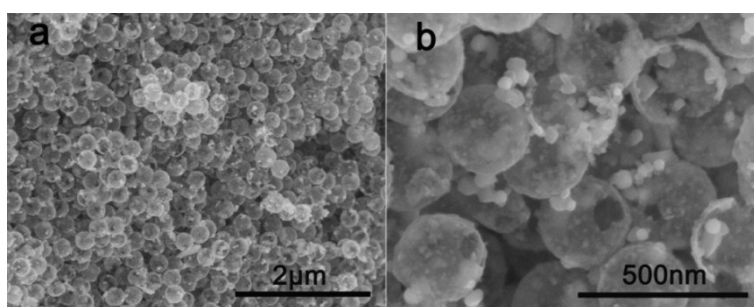


Fig. S9 SEM images of  $mTiO_2@C-Ni/700$  after five catalytic reaction

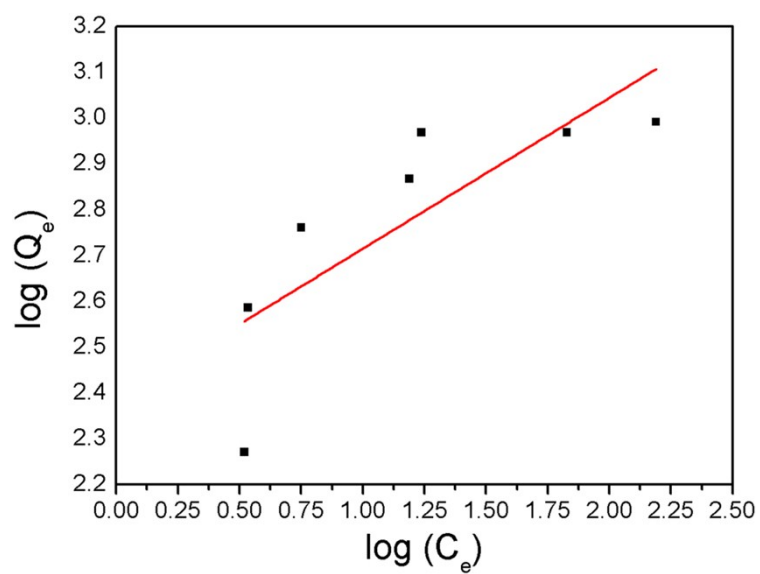


Fig. S10 Linear fitting of adsorption isotherms plots based on Freundlich model.

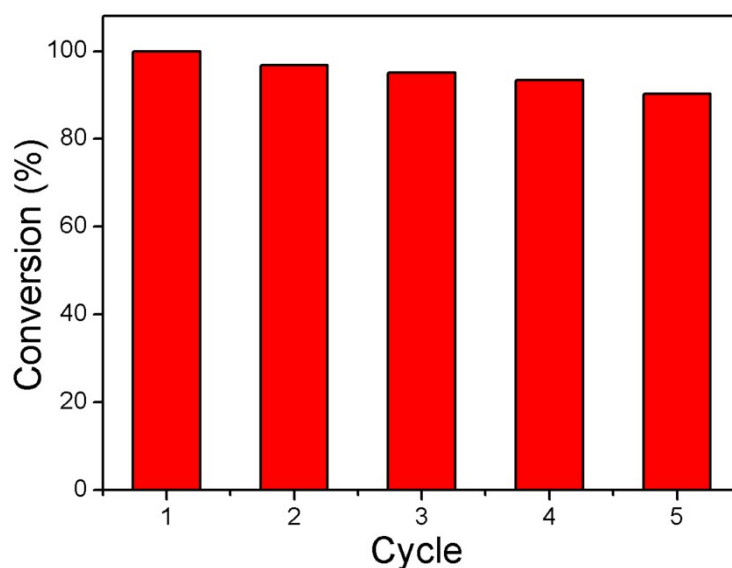


Fig. S11 the recyclability of the mTiO<sub>2</sub>@C-Ni/700 as the absorbent for BHb.

**Table S2** the estimate of Langmuir model and Freundlich model

| Langmuir       |        |                | Freundlich     |      |                |
|----------------|--------|----------------|----------------|------|----------------|
| Q <sub>m</sub> | b      | R <sup>2</sup> | K <sub>F</sub> | n    | R <sup>2</sup> |
| 1027.24        | 0.0067 | 0.99375        | 242.93         | 3.04 | 0.56769        |

## References

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