Electronic Supplementary Material (ESI) for RSC Advances.

Synthesis under mild conditions and high catalytic property of bimetal Ni-Cu/SiO_2 hollow spheres

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Synthesis process in details: First step, monodispersed silica colloidal spheres were synthesized according to the Stöber method [34]. The silica particles have uniform sphere shape with 250 nm approximately. At room temperature, $NH_3.H_2O$ (4 mL) were added dropwise to analytical grade $Cu(NO_3)_2.3.5H_2O$(0.4 mmol) to form the copper-ammonia coordination complex ions. Second, $Ni(CH_3COO)_2.4H_2O$ (0.8 mmol) and silica colloidal spheres (0.15 g) were homogeneously dispersed in deionized water (50 mL). Third, the copper-ammonia coordination complex solution and homogeneous silica solution were both transferred to Teflon-line stainless steel autoclaves and maintained at 120 ℃ for different time. The regular colour products were collected by centrifugation and rinsed with distilled water for several times until the pH was 7. Finally, the product was dried in the oven at 60 ℃ for several hours.

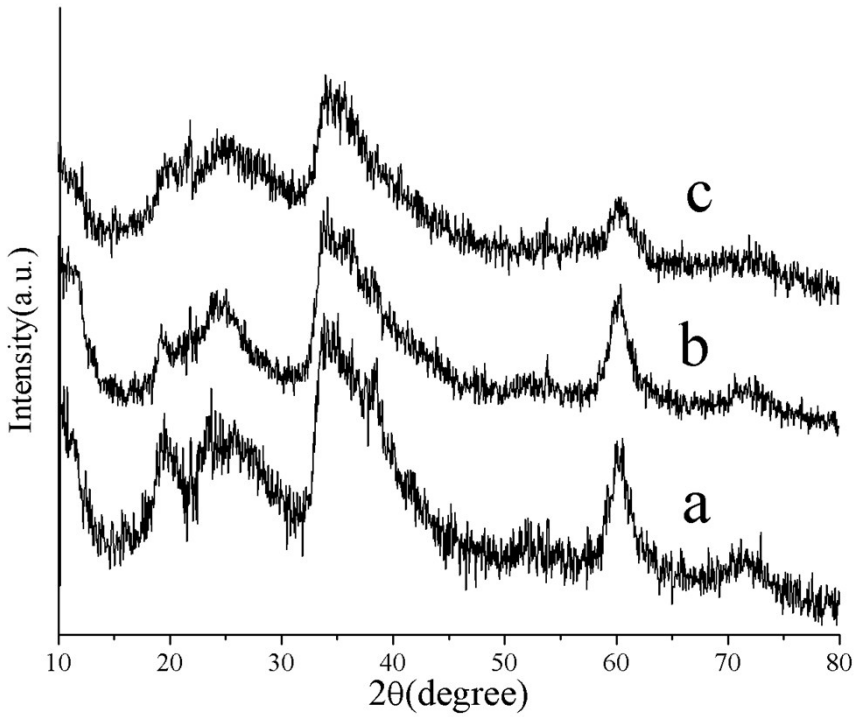


Fig.S1 XRD pattern of bimetal Ni-Cu silicate prepared using different Ni:Cu ratio: a 2/1, b 1/1, c 1/2. Synthesis condition : reaction temperature 120 ℃.

Table S1 nickel and copper contents of the bimetal Ni-Cu silicate hollow spheres

Ni:Cu theory ratio	Ni:Cu experimental ratio
Ni:Cu(2/1)	22.87%:12.64%
Ni:Cu(1/1)	19.93%:21.56%
Ni:Cu(1/2)	8.23%:16.18%

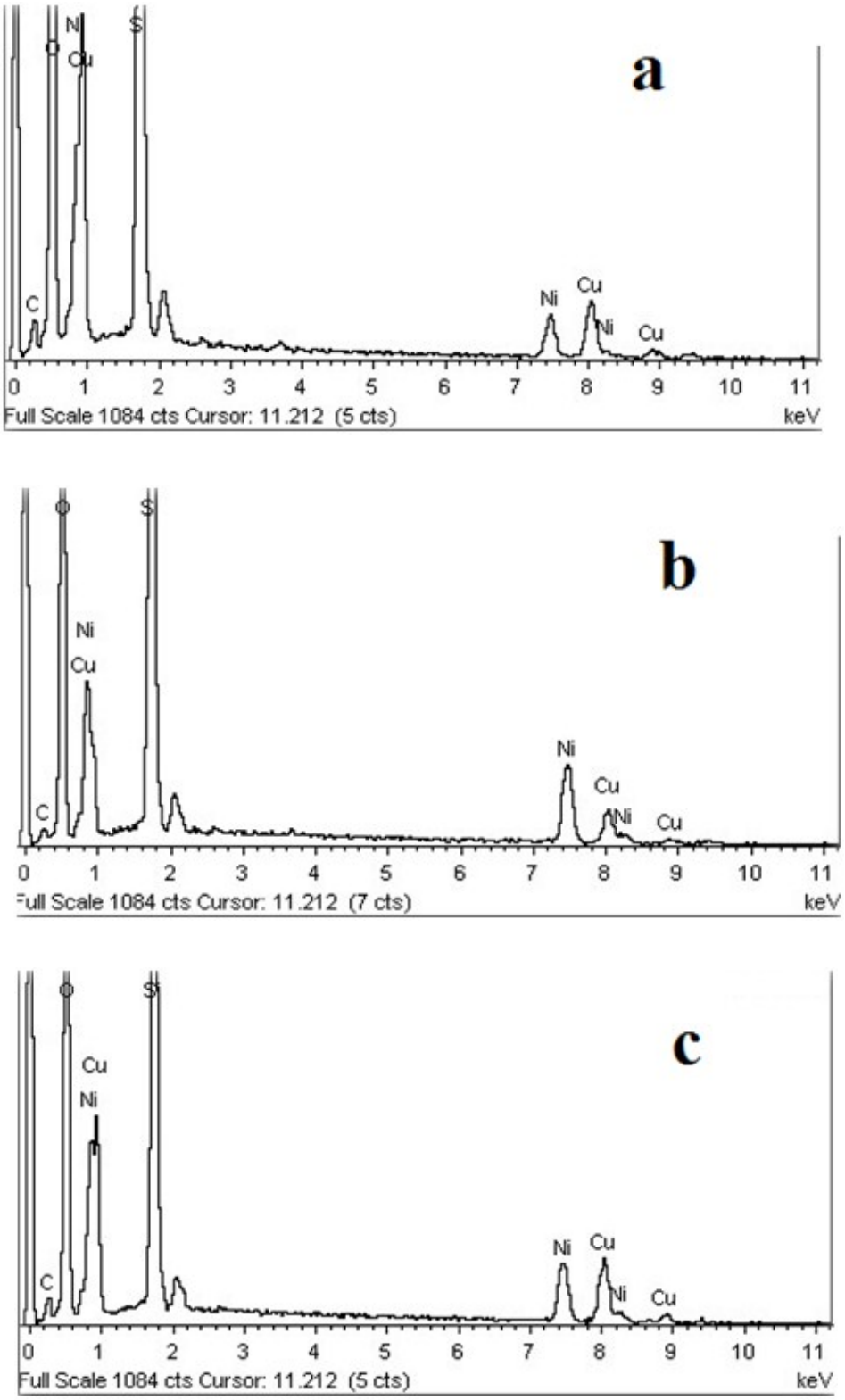


Fig. S2 Energy dispersive X-ray spectrum of the of the bimetal Ni-Cu silicate hollow spheres, a Ni:Cu 2/1, b Ni:Cu 1/1, c Ni:Cu 1/2.

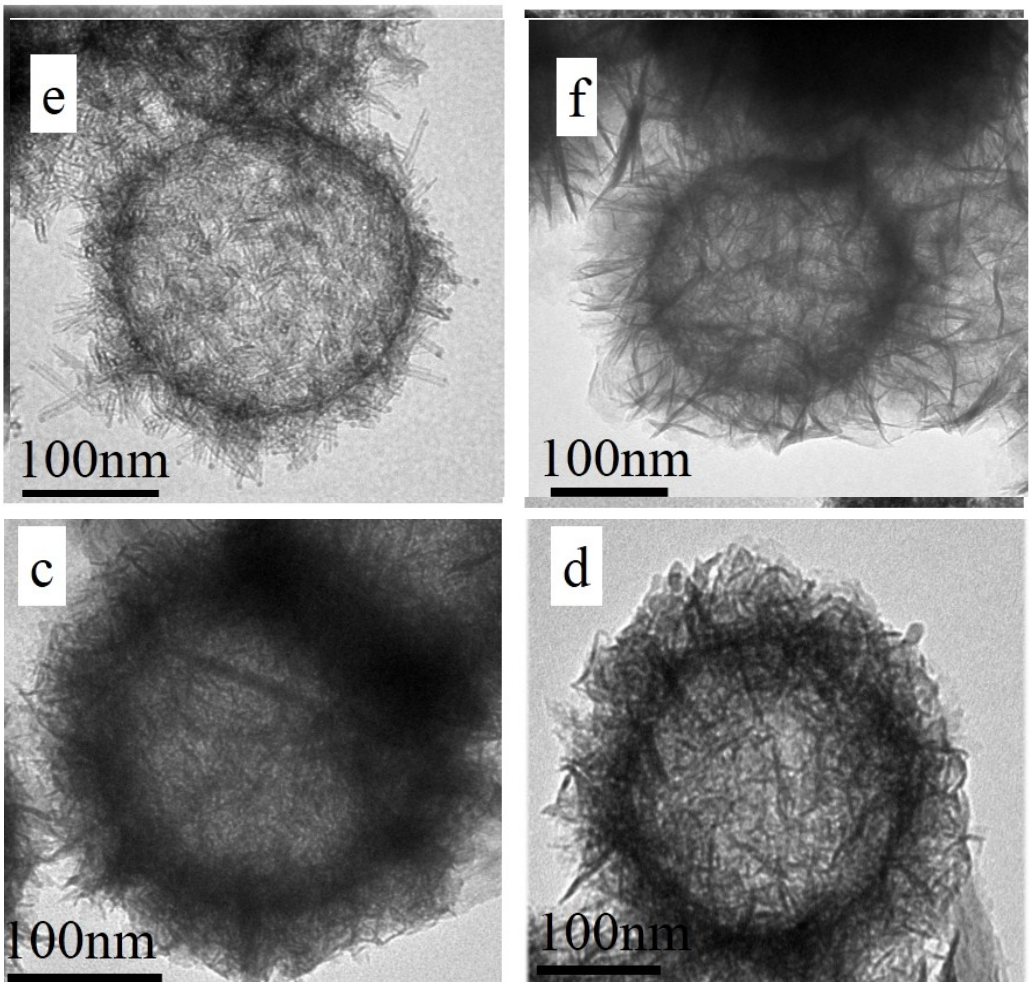


Fig.S3 TEM images of Ni-Cu silicate hollow spheres prepared using different reaction time (a) 3 h (b) 6 h (c) 12 h (d) 18 h (e) 24 h. Synthesis conditions: the same Si:M ratio (2:1) and Ni:Cu ratio (2:1), reaction temperature 120 ℃, (f) 24 h. Si:Ni ratio (2:1), reaction temperature 180℃.

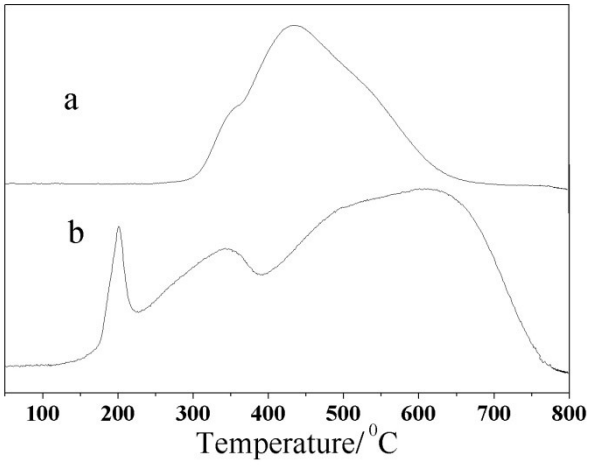


Fig.S4 TPR profiles of (a) Ni/SiO_2 and (b) $Ni\text{-}Cu/SiO_2$

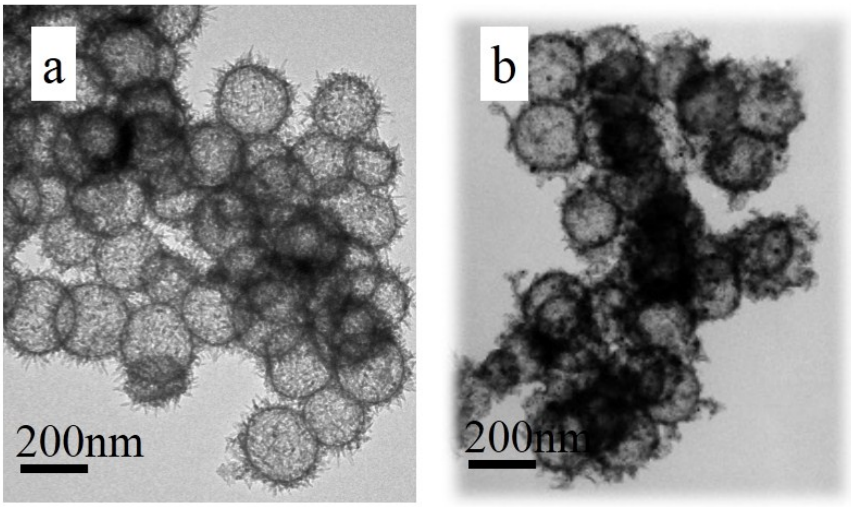
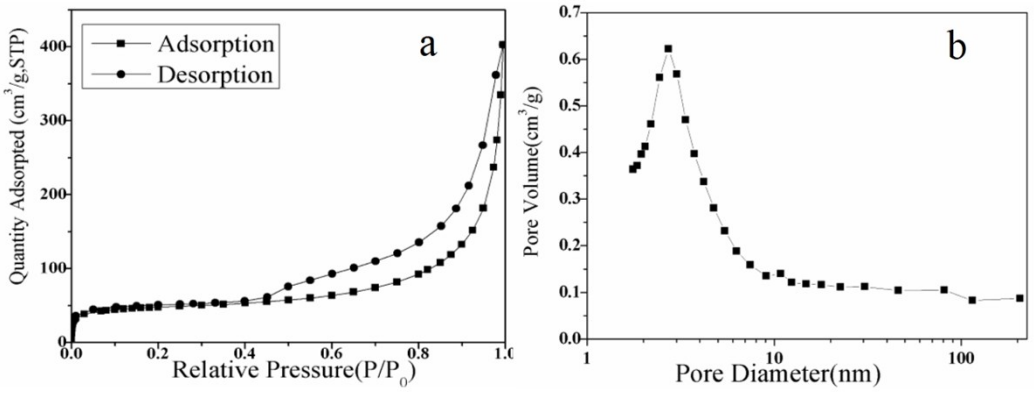


Fig.S5 TEM images of bimetal Ni-Cu silicate hollow spheres (a) before reduction and TEM images of bimetal $Ni\text{-}Cu/SiO_2$ hollow spheres (b) after reduction



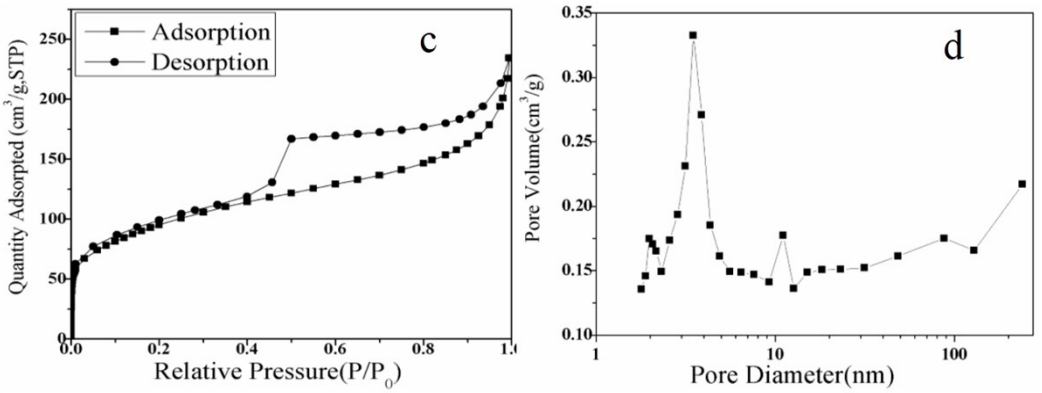


Fig.S6 N_2 adsorption/desorption isotherm and pore diameter distribution of the Ni-Cu silicate (a) and Ni-Cu silica (c), pore diameter distribution of the Ni-Cu silicate (b) and Ni-Cu silica (d)

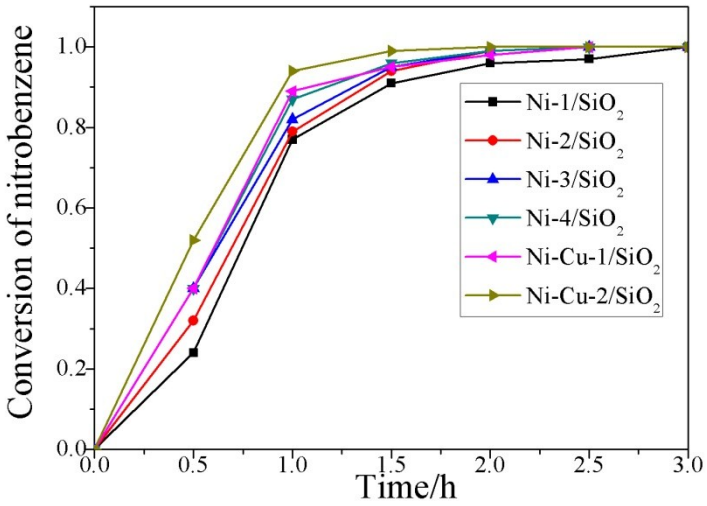


Fig.S7 Conversion of nitrobenzene of different catalysts for hydrogenation Nitrobenzene