Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting Information

Hierarchical Structure Based on Pd (Au) Nanoparticles Grafted onto Magnetite Cores and Double Layered Shells: Enhanced Activity for Catalytic Application

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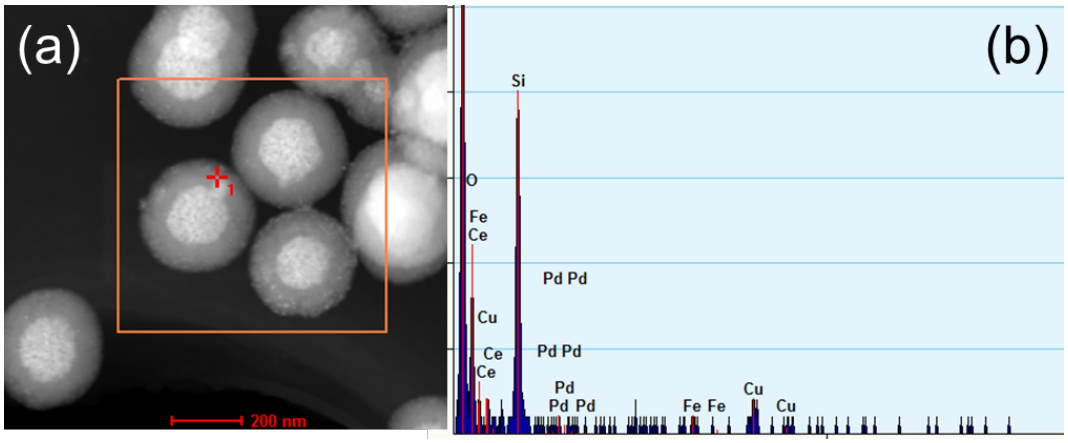

Figure S1. (a) High angle annular dark field-scanning transmission electron microscopy (HAADF-STEM) image of Fe_3O_4@SiO_2@CeO_2/Pd microspheres, (b) the corresponding EDX spectra of Fe_3O_4@SiO_2@CeO_2/Pd microspheres.

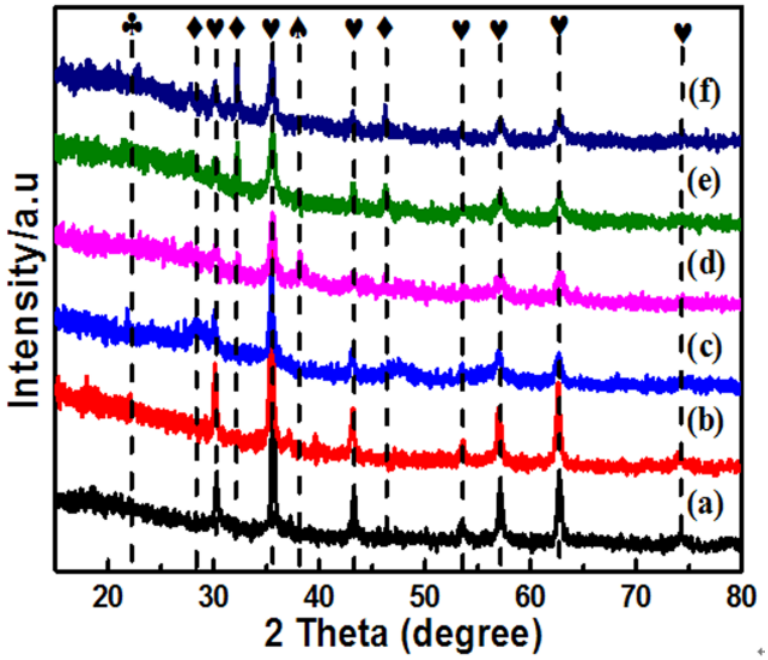

Figure S2. XRD patterns of (a) Fe_3O_4, (b) Fe_3O_4@SiO_2, (c) Fe_3O_4@SiO_2@CeO_2, (d)Fe_3O_4@SiO_2@CeO_2/Au, (e) Fe_3O_4@ SiO_2@CeO_2/Pd, (f)Fe_3O_4@SiO_2@CeO_2 /Au-Pd microspheres, where the reflections peaks maked by ♥, ♣,♦ and ♠ correspond to Fe_3O_4, SiO_2, CeO_2 and Au, respectively.

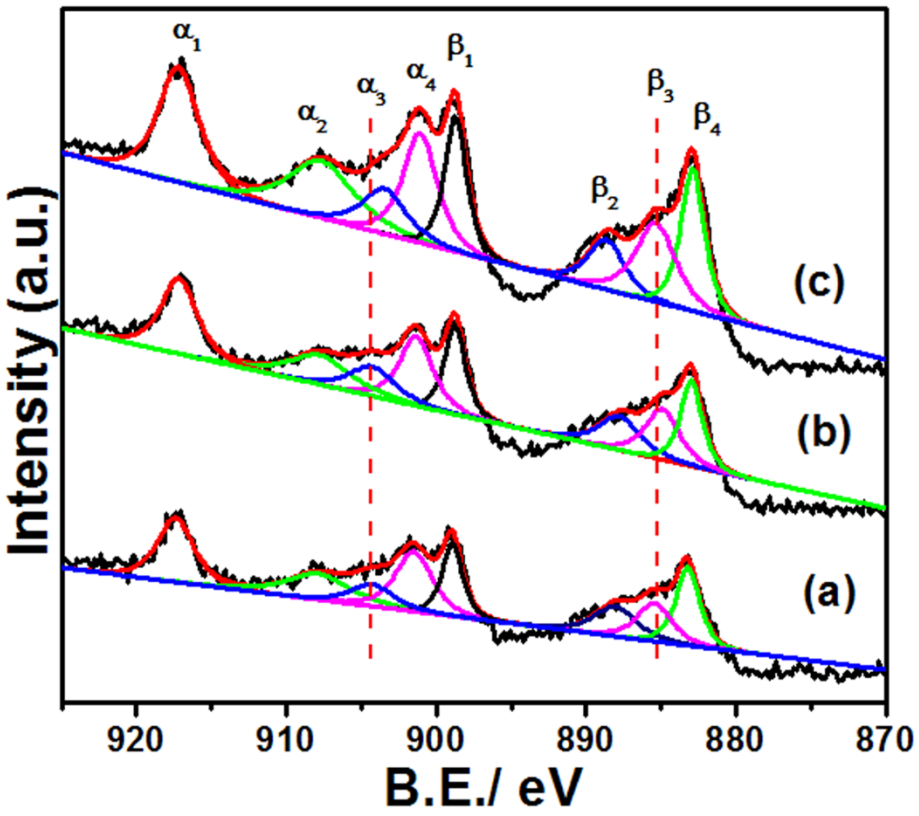

Figure S3. Experimental and fitted XPS spectra of the (a) fresh Fe_3O_4@SiO_2@CeO_2/Pd microspheres catalyst; (b) used Fe_3O_4@SiO_2@CeO_2/Pd microspheres catalyst; (c) Fe_3O_4@SiO_2@CeO_2 support.

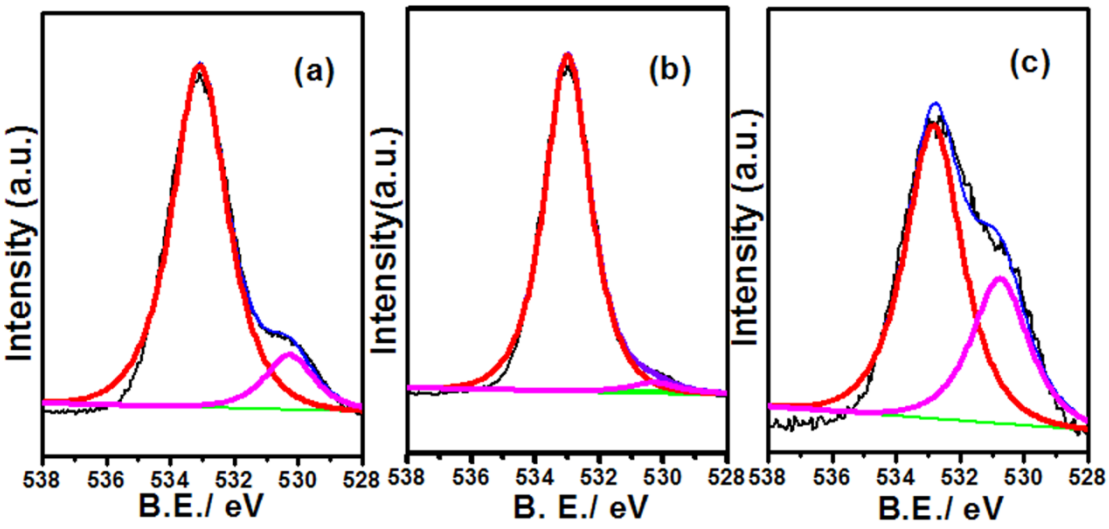

Figure S4. Experimental and fitted XPS spectra of O1s of the (a)Fe_3O_4@SiO_2@CeO_2 support; (b) fresh Fe_3O_4@SiO_2@CeO_2/Pd and (c) used Fe_3O_4@SiO_2@CeO_2/Pd microspheres catalysts.

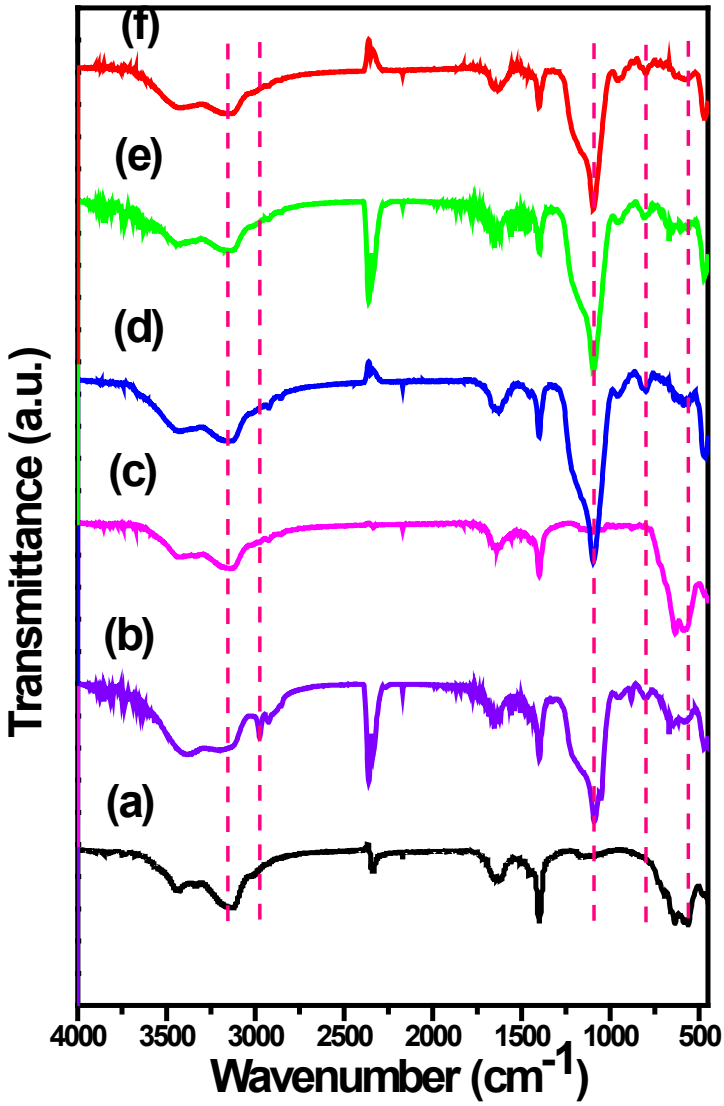

Figure S5. FTIR spectra of the as-synthesized Fe_3O_4/Pd (a), Fe_3O_4@SiO_2/Pd(b), Fe_3O_4@CeO_2/Pd(c), Fe_3O_4@SiO_2@ CeO_2/Au(d), Fe_3O_4@SiO_2@CeO_2/Pd(e), Fe_3O_4@SiO_2@CeO_2 /Au-Pd (f) microspheres.

To confirm middle silica layer coated on the surface of the magnetite cores, FTIR spectra of the Fe_3O_4/Pd, Fe_3O_4@SiO_2/Pd, Fe_3O_4@CeO_2/Pd, Fe_3O_4@SiO_2@CeO_2/Au, Fe_3O_4@SiO_2@CeO_2/Pd, Fe_3O_4@SiO_2@CeO_2/Au-Pd microspheres are shown in the Figure S5.The assignments of the strong bands Si-O-Si (1089, 798 cm^{-1}) and Si-OH (957 cm^{-1}) indicates existence of the silica. The peaks at 633 cm^{-1}, 577 cm^{-1} and 563 cm^{-1} are attributed to Fe-O and Ce-O vibrations, respectively.

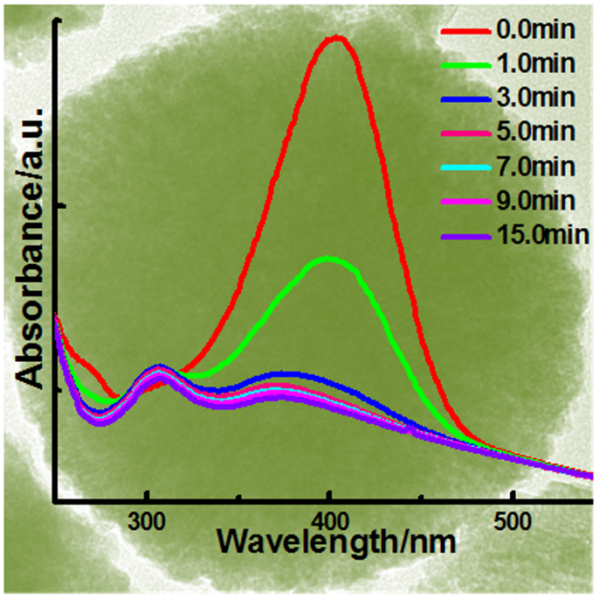

Figure S6.UV-Vis absorption spectra for the catalytic reduction of 4-NP to 4-AP over CeO_2@Pd microspheres catalyst.

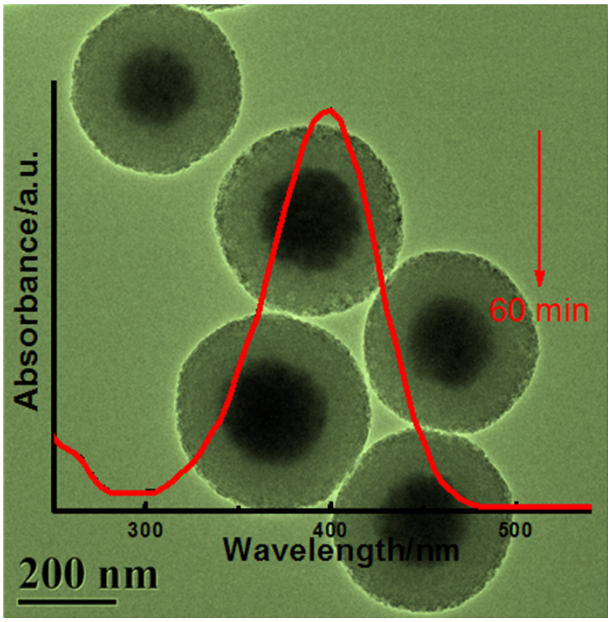

Figure S7.UV-Vis absorption spectra for the catalytic reduction of 4-NP to 4-AP over Fe_3O_4@SiO_2@CeO_2 microspheres catalyst.