

Electronic Supplementary Information

Title: Efficient Fe₃O₄ Nanoparticle Catalysts for Depolymerization of Polyethylene Terephthalate

Yoonjeong Jo,^a Eun Jeong Kim,^a Jueun Kim^a and Kwangjin An^{*a}

^a School of Energy and Chemical Engineering, and Graduate School of Carbon Neutrality, Ulsan National Institute of Science and Technology (UNIST), Ulsan 44919, Republic of Korea

* To whom correspondence should be addressed (E-mail: kjan@unist.ac.kr)

RECEIVED DATE

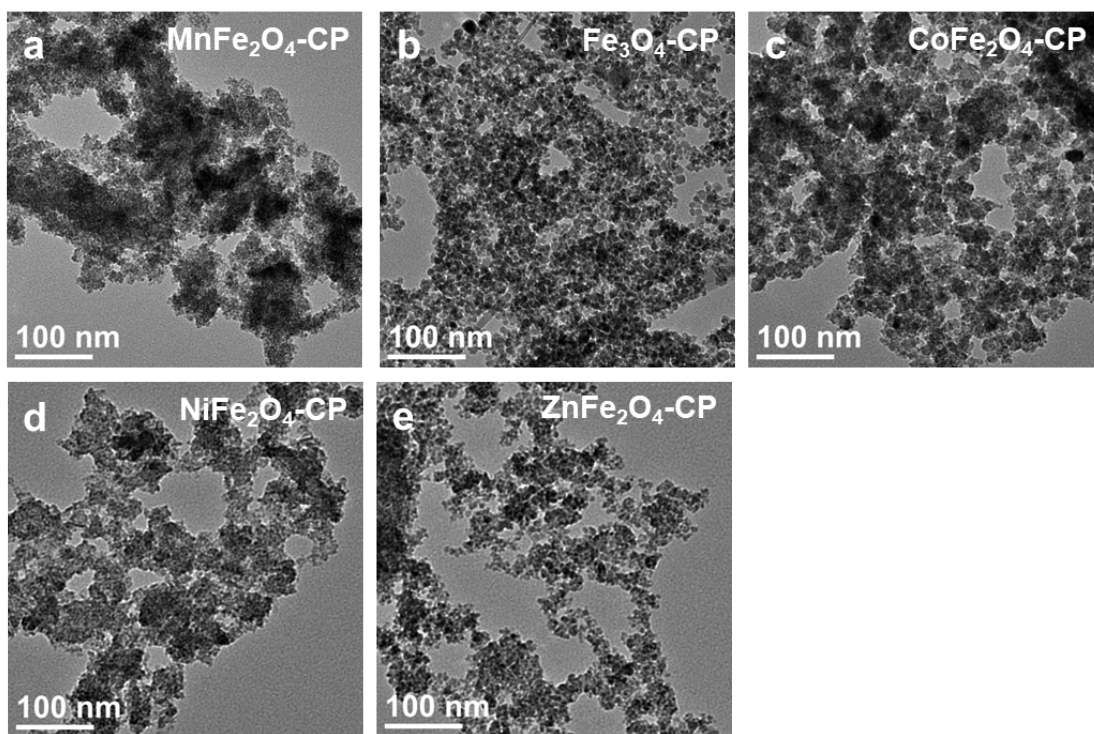


Fig. S1. TEM images of Fe₃O₄ prepared by various synthesis methods. (a) MnFe₂O₄-CP, (b) Fe₃O₄-CP, (c) CoFe₂O₄-CP, (d) NiFe₂O₄-CP, and (e) ZnFe₂O₄-CP.

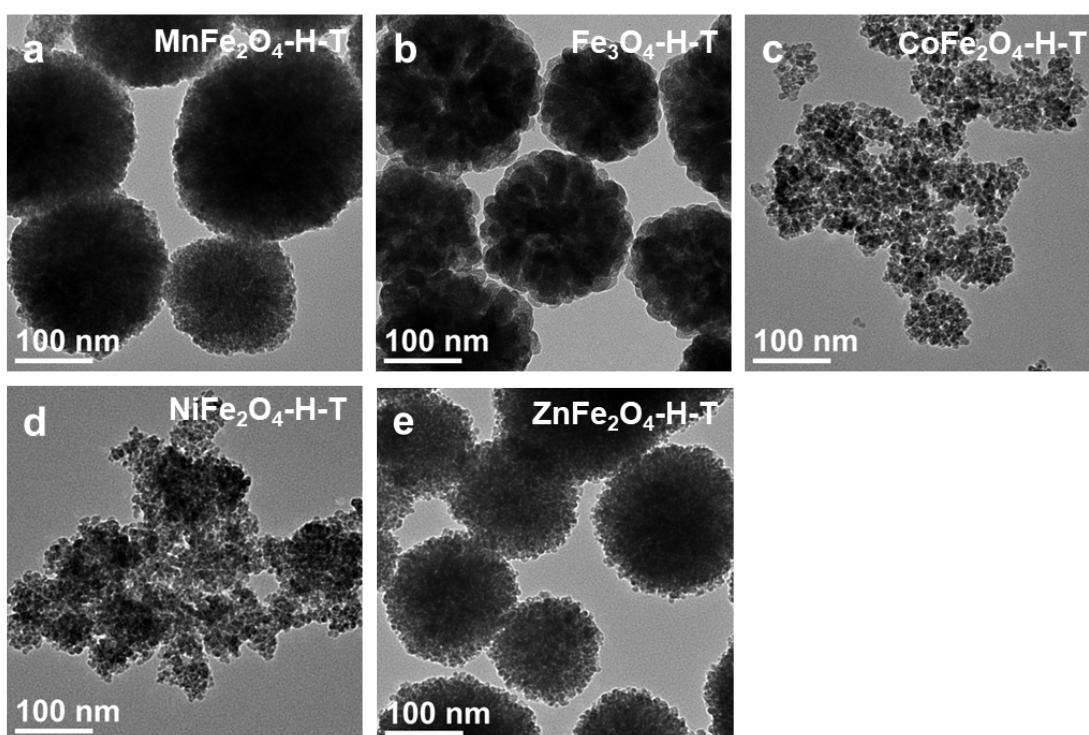


Fig. S2. TEM images of Fe₃O₄ prepared by various synthesis methods. (a) MnFe₂O₄-H-T, (b) Fe₃O₄-H-T, (c) CoFe₂O₄-H-T, (d) NiFe₂O₄-H-T, and (e) ZnFe₂O₄-H-T.

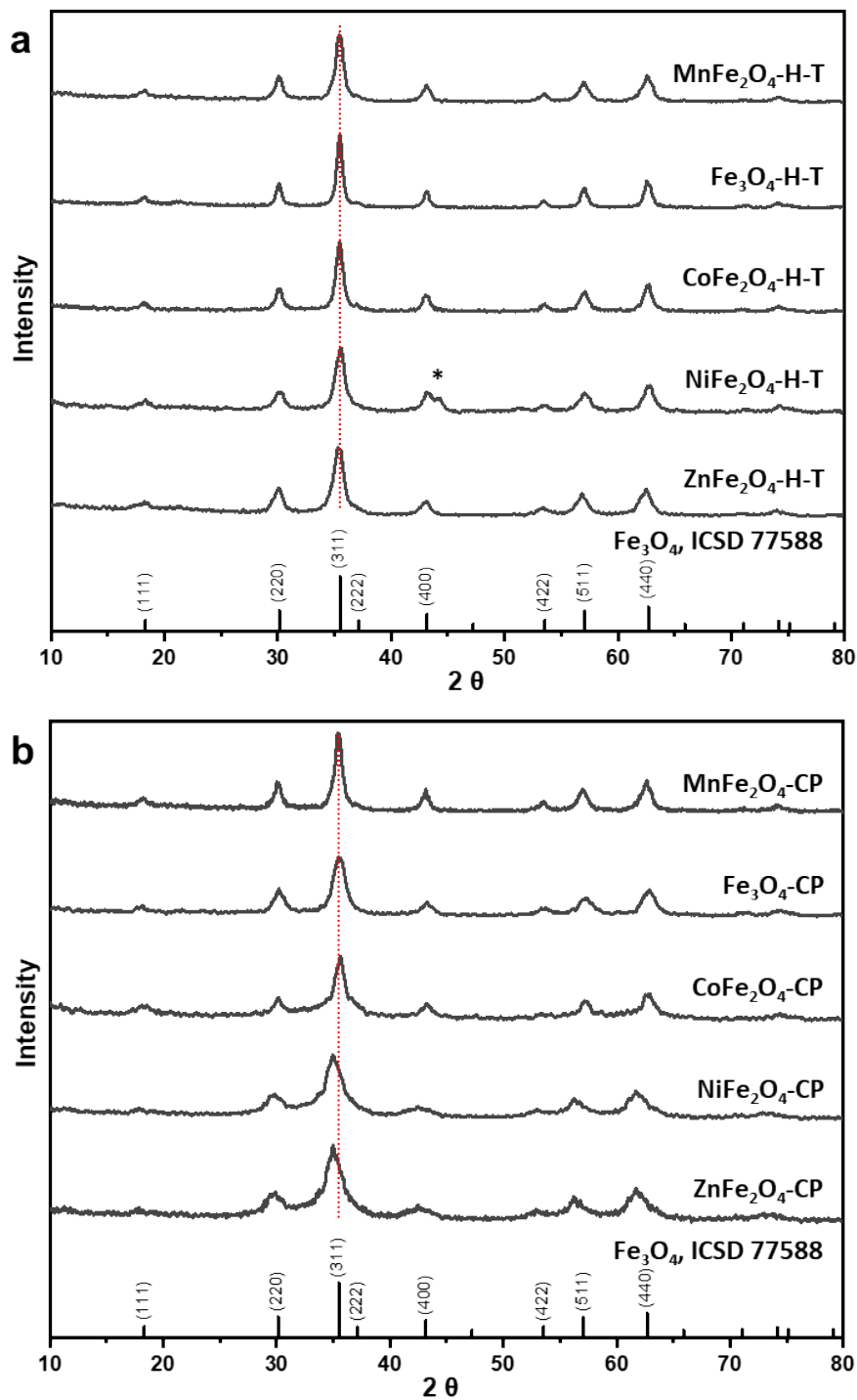


Fig. S3. XRD patterns of $M\text{Fe}_2\text{O}_4$, $M=\text{Mn, Fe, Co, Ni, and Zn}$ (a) catalysts prepared by the H method using Triton X-100, and (b) catalysts prepared by the CP method. Asterisks indicate peaks corresponding to metallic Ni (ICSD number 53807).

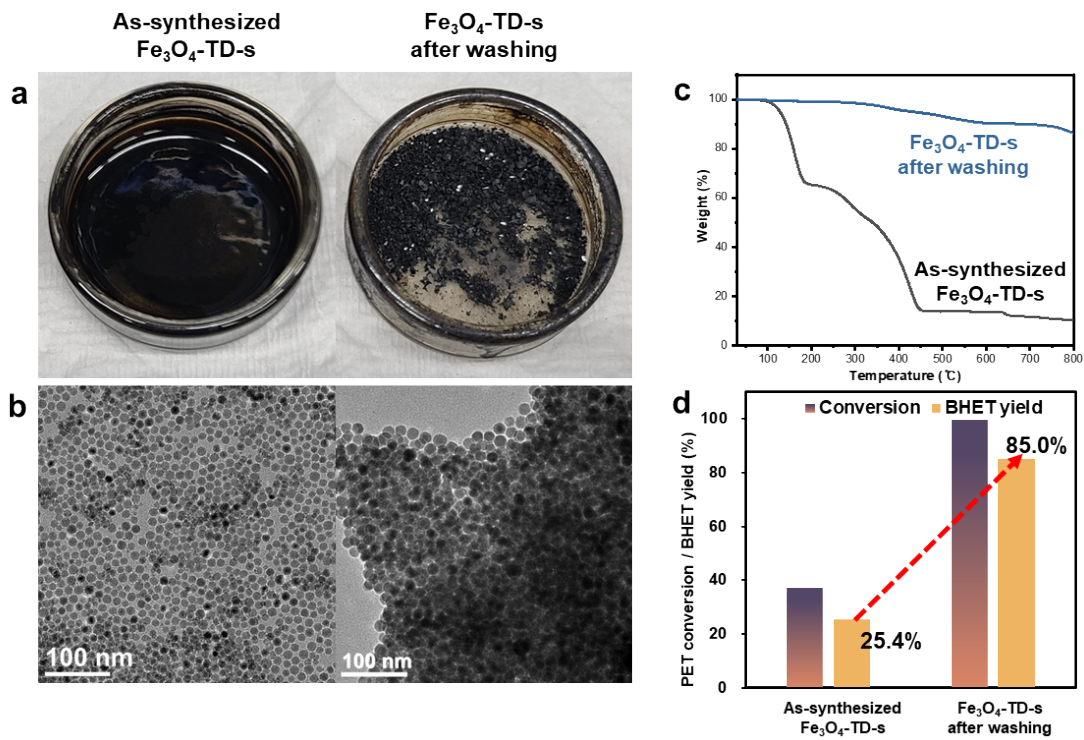


Fig. S4. Effect of surfactant removal on Fe_3O_4 -TD-s NPs. (a) Photographs of waxy (left) and fine powder (right) forms of Fe_3O_4 -TD-s NPs before and after the washing process. (b) TEM images, and (c) TGA curves of as-synthesized (left) and heavily washed (right) Fe_3O_4 -TD-s NPs. (d) Changes in PET conversion and BHET yield.

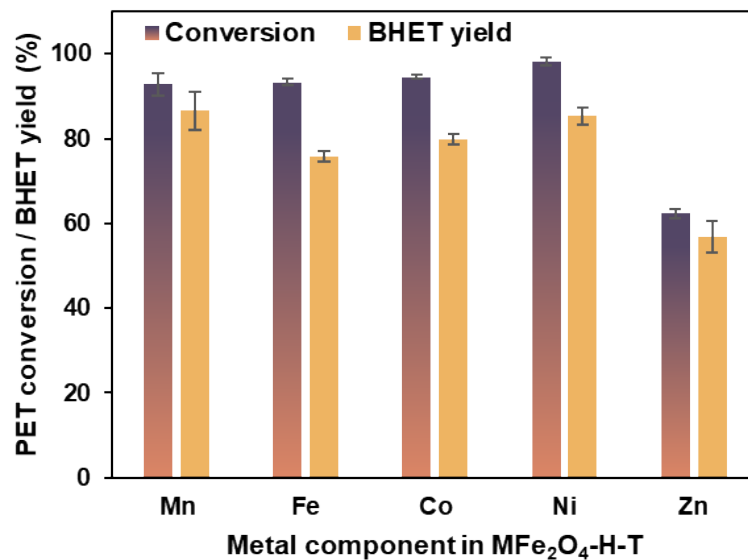


Fig. S5. Catalytic performance of PET glycolysis over mixed ferrite (MFe_2O_4 -H-T) NPs.

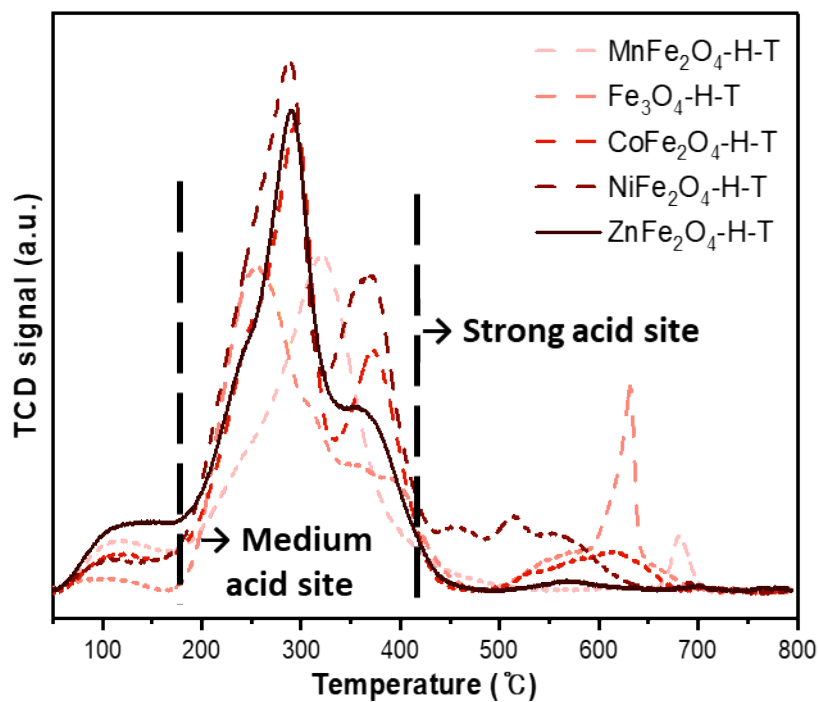


Fig. S6. Temperature-programmed desorption (TPD) profiles by ammonia for MnFe₂O₄-H-T NPs.

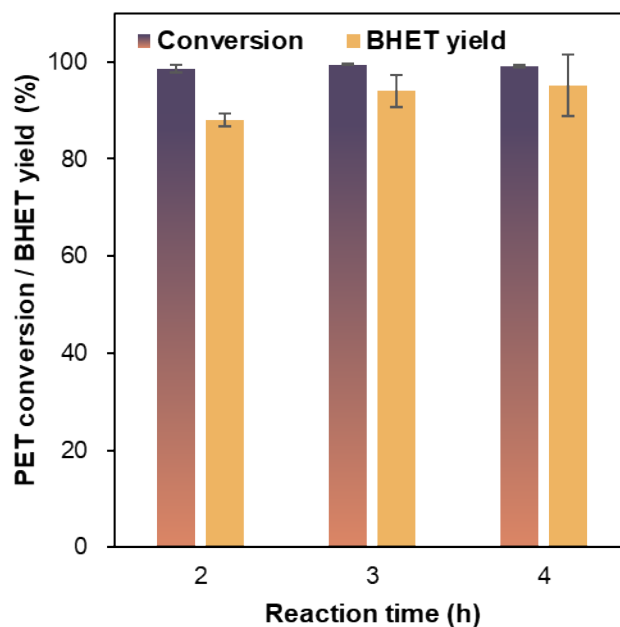


Fig. S7. Effect of reaction time in PET glycolysis. Reaction conditions: PET 1 g, EG 3 mL, catalyst 0.01 g, and reaction temperature 195°C.

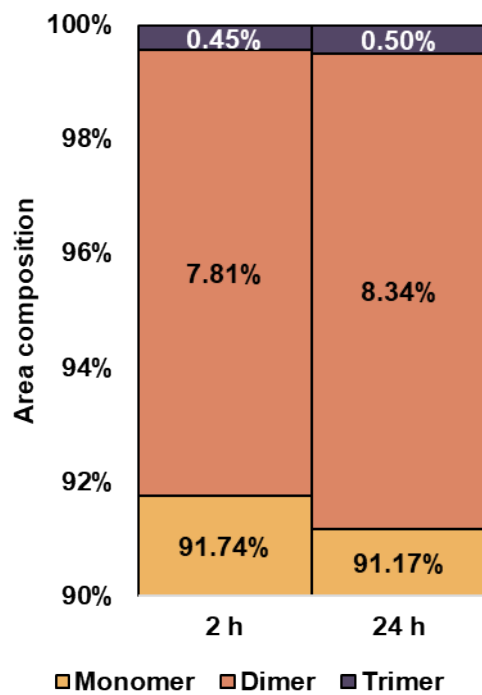


Fig. S8. Product distribution of BHET as a function of glycolysis reaction time by HPLC analysis.

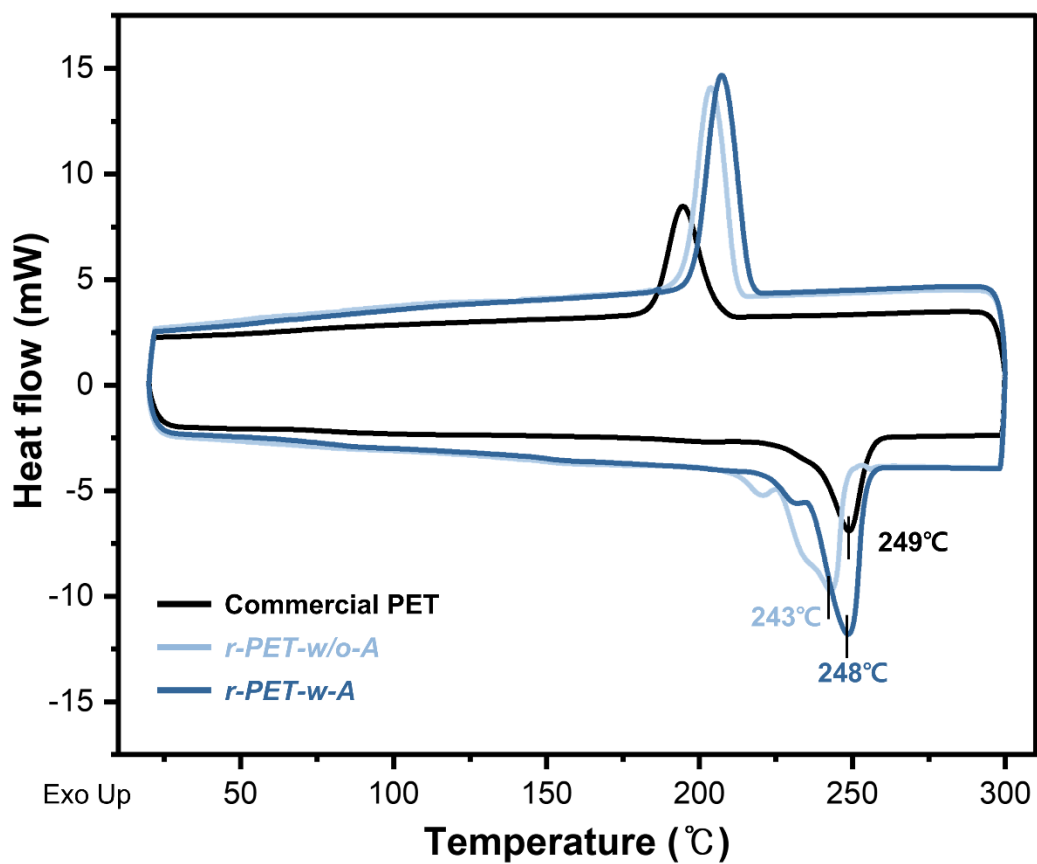


Fig. S9. DSC curves of three kinds of PETs: Commercial PET, *r*-PET-w/o-A, and *r*-PET-w/o-A.

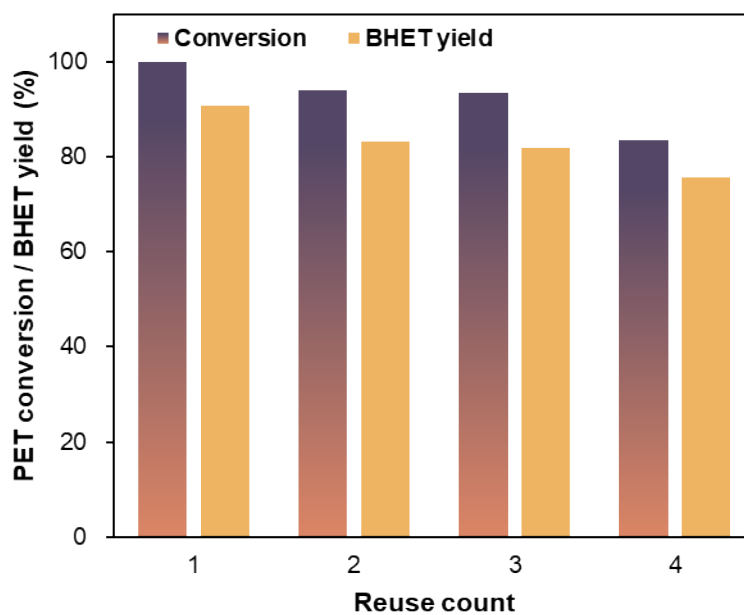


Fig. S10. Reusability test of Fe₃O₄-CP NPs in PET glycolysis.

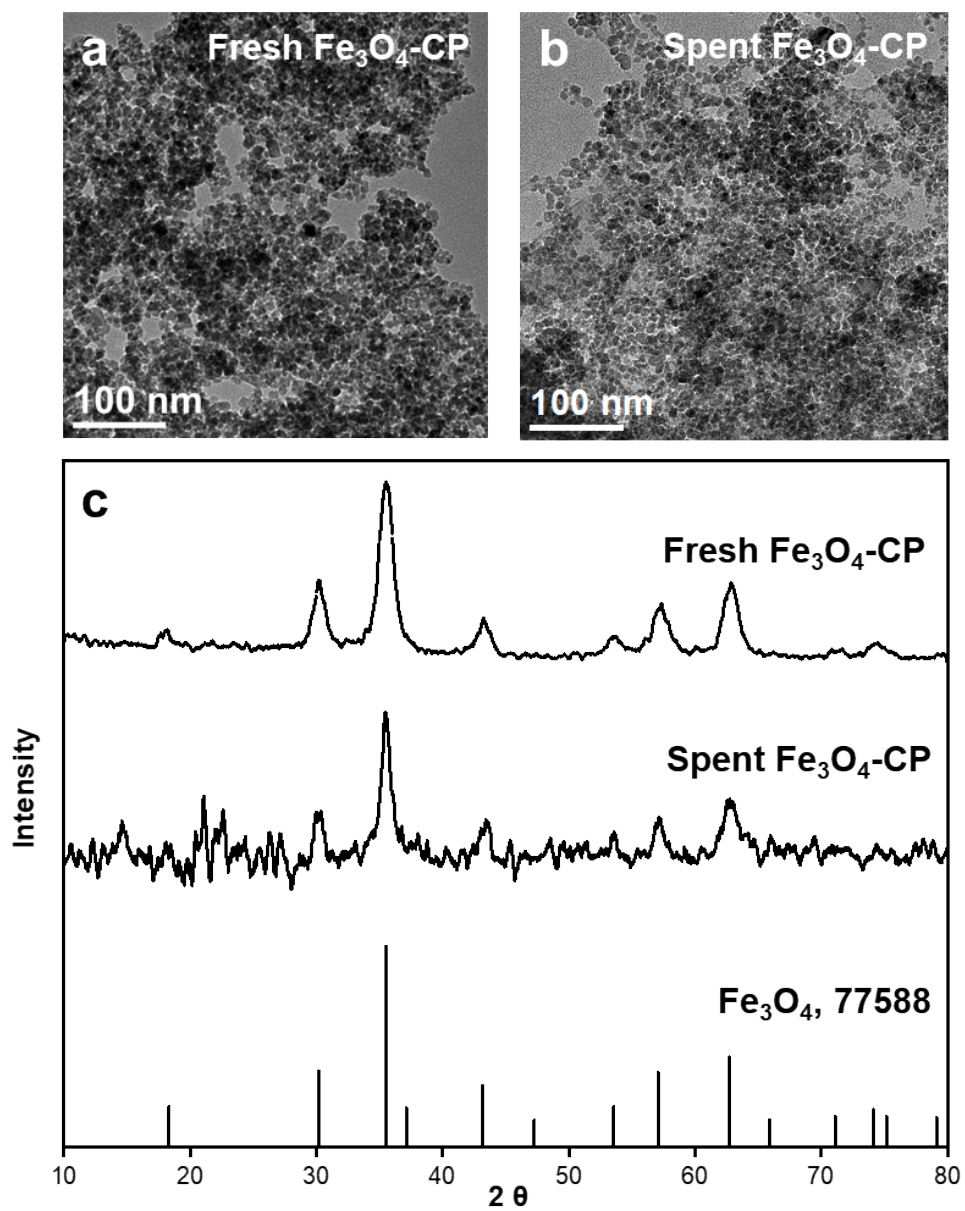


Fig. S11. (a,b) TEM images and (c) XRD patterns of the fresh and spent Fe_3O_4 -CP NP catalysts after reusability experiments.