Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Supporting Information

Two-dimensional oxygen deficient ZnO_{1-x} nanosheets as a highly selective fluorescence probe for ferritin detection: The electron transfer biosensor (ETBS)

Priyanka Rana[1], Sivakumar Musuvadhi Babulal[1], Hui-Fen Wu*[1, 2, 3,4,5]

[1]Department of Chemistry, National Sun Yat-Sen University, Kaohsiung, 70, Lien-Hai Road, Kaohsiung, 80424, Taiwan

[2]School of Pharmacy, College of Pharmacy, Kaohsiung Medical University, Kaohsiung, 807, Taiwan

[3]Institute of Medical Science and Technology, National Sun Yat-Sen University, Kaohsiung, 80424, Taiwan

[4]School of Medicine, College of Medicine, National Sun Yat-Sen University, Kaohsiung, 80424, Taiwan

[5]Institute of Precision Medicine, National Sun Yat-Sen University, Kaohsiung, 80424, Taiwan.

*Corresponding author, Phone: +886-7-5252000-3955; Fax: +886-7-5253909

Email: hwu@faculty.nsysu.edu.tw (Prof H.-F. Wu)

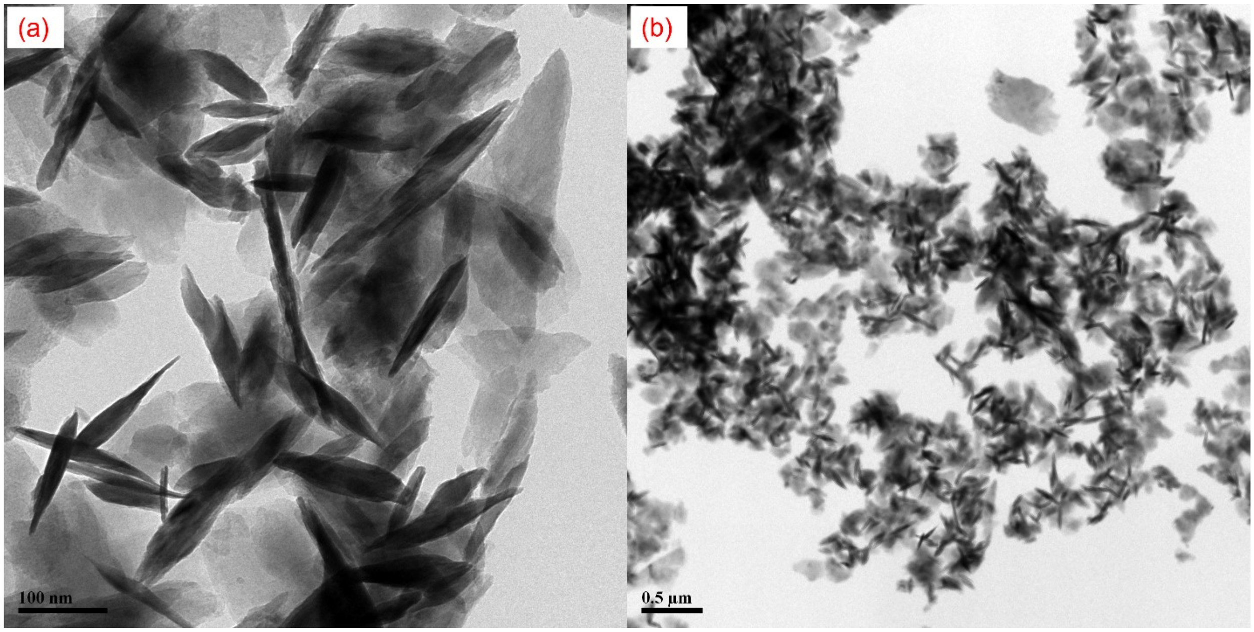

Fig. S1. Characterization of ZnO_{1-x} nanosheets using TEM to detect the surface morphology of nanosheets for the scale of (a) 100 nm and (b) 0.5 μm scale.

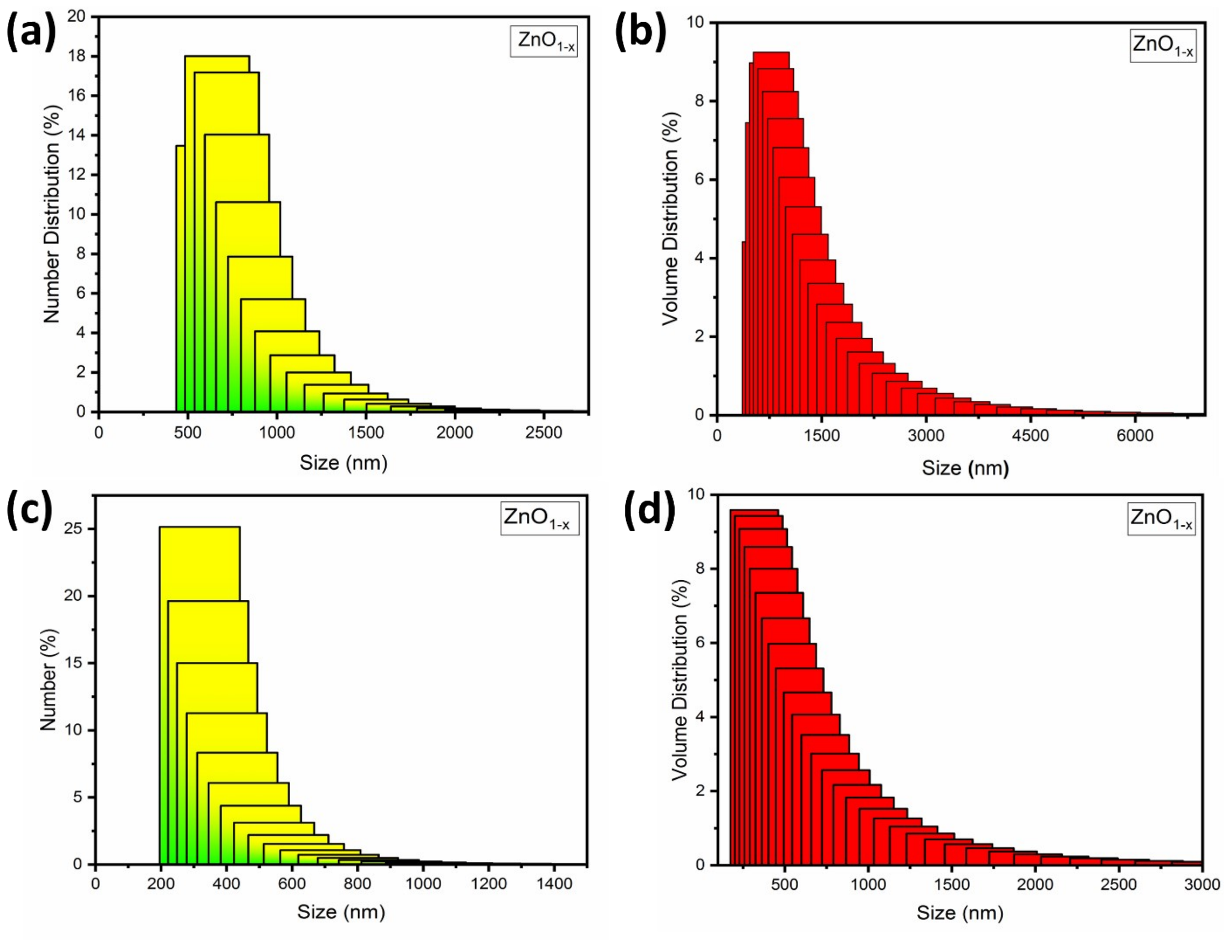

Fig. S2. Dynamic Light Scattering (DLS) size distribution; (a) % number distribution and (b) % volume distribution for synthesized ZnO_{1-x} nanosheets before probe-ultrasonication, (c), (d) shows size distribution after probe-ultrasonication.

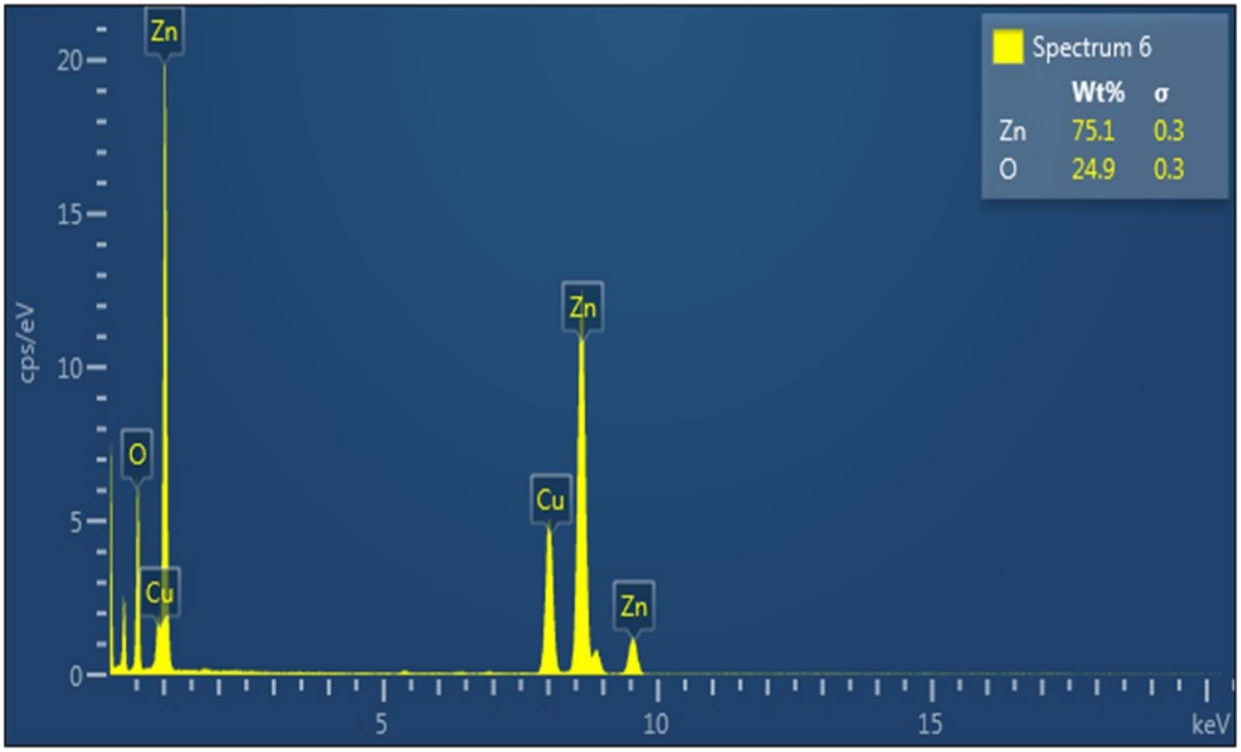

Fig. S3. Energy-dispersive X-ray spectra (EDS) of the synthesized ZnO_{1-x} nanosheets showing elemental mapping.

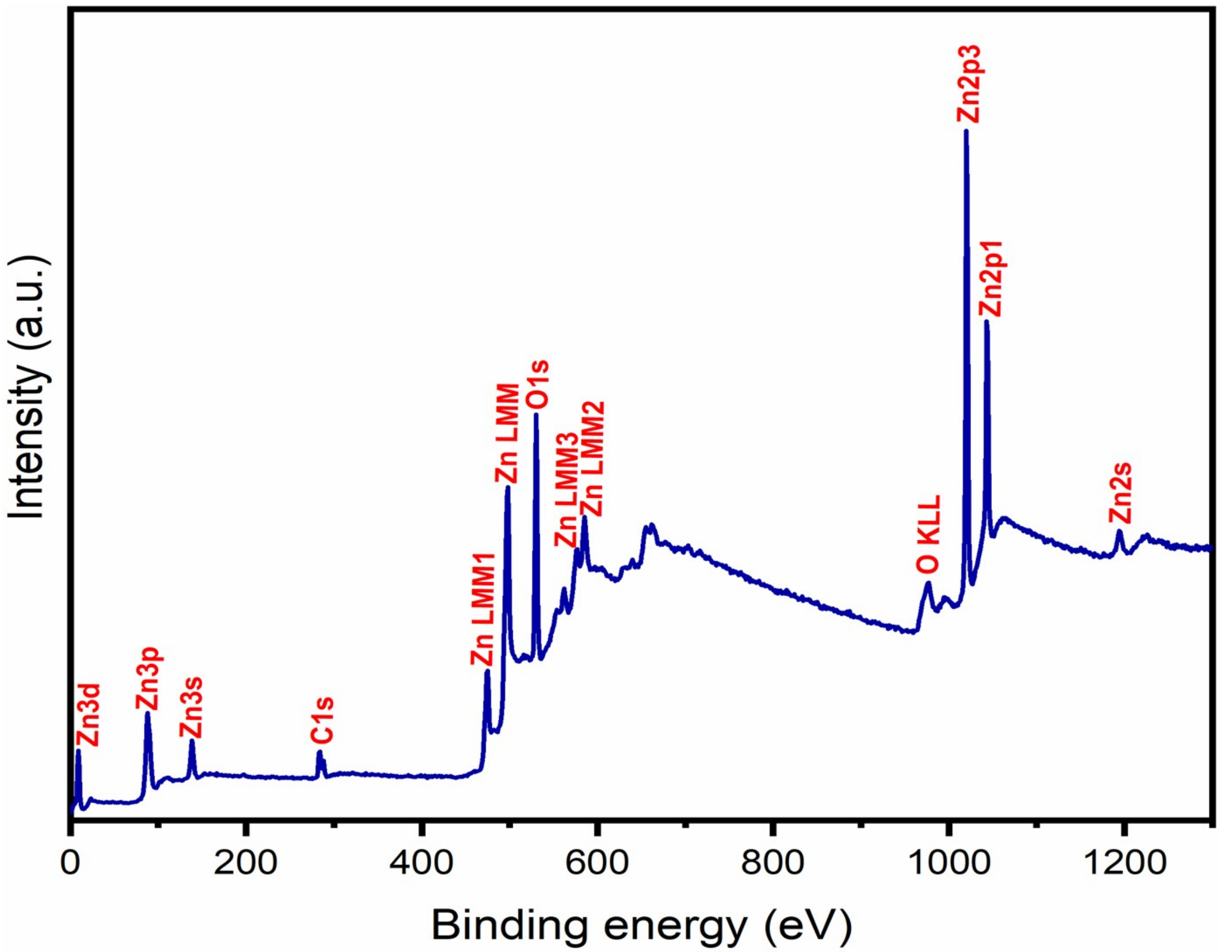

Fig. S4. XPS survey scan spectra for ZnO_{1-x} nanosheets.

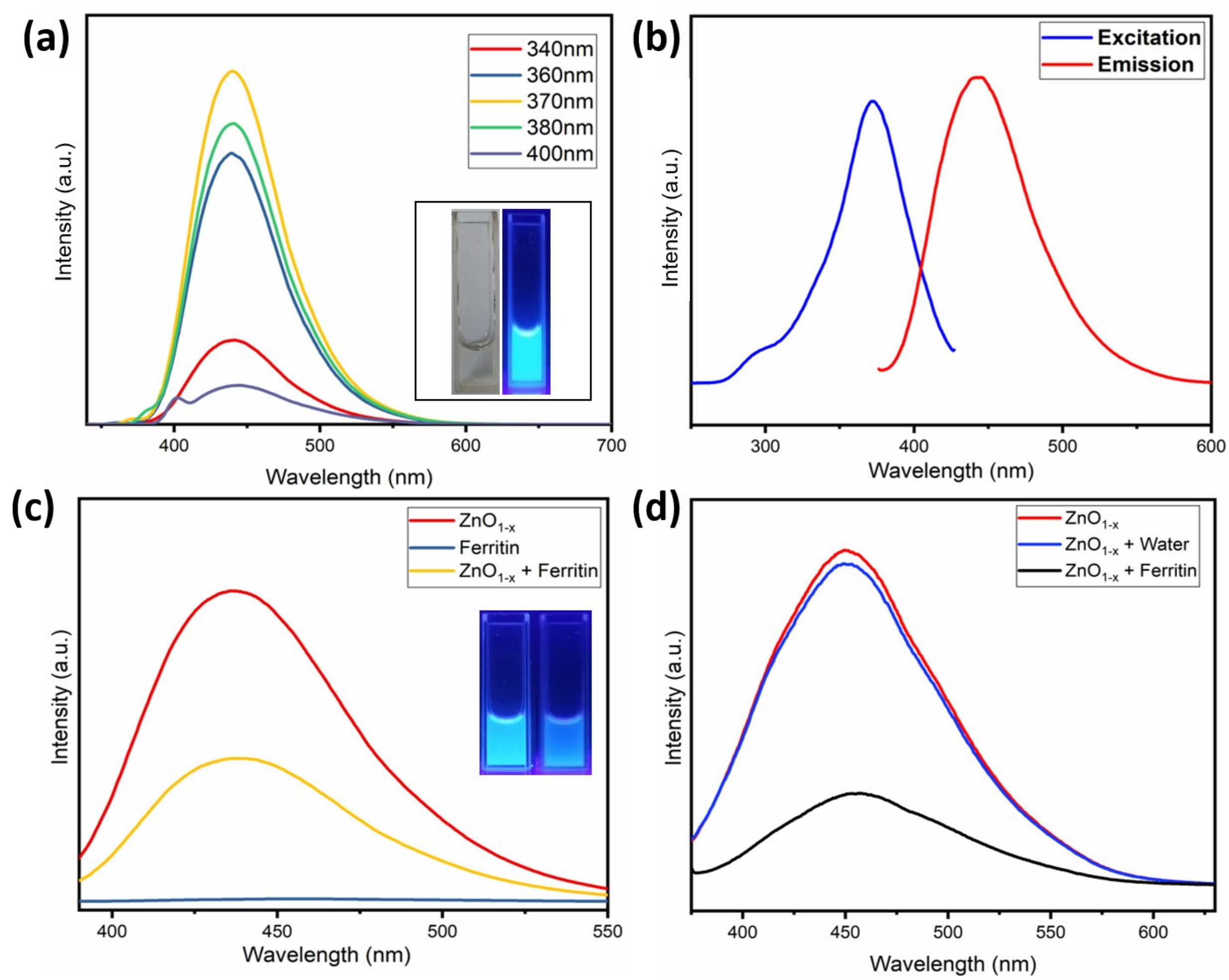

Fig. S5. PL study of the 2D ZnO_{1-x} nanosheets (a) Optimization of fluorescence intensity at various wavelengths, (b) Excitation and emission spectra for the ZnO_{1-x} nanosheets, (c) Fluorescence quenching experiment after the addition of ferritin, (d) Effect of dilution on fluorescence intensity of ZnO_{1-x} nanosheets.

S1. Quantum yield equation

The quantum yield of the synthesized material was calculated using the equation as below:

$$\varphi_{ZnO_{1-x}} = \varphi_{Q.S} \times \frac{F(AUC)_{ZnO_{1-x}}}{F(AUC)_{Q.S}} \times \frac{Absorbance_{Q.S}}{Absorbance_{ZnO_{1-x}}} \times \frac{\eta_{ZnO_{1-x}}}{\eta_{Q.S}}$$

where φ is Quantum yield, Q.S. = Quinine sulfate (reference), F (AUC) = Fluorescence Area under the curve, Absorbance = Absorbance at 370 nm, η = Solvent refractive index of the sample (water: 1.333).

The quantum yield of ZnO_{1-x} was calculated using the values as:

$\varphi_{Q.S}$ = 54.6%, $F(AUC)_{ZnO1-x}$ = 46,672.54, $F(AUC)_{Q.S}$ = 60,260.0, $Absorbance_{Q.S}$ = 2.9, $Absorbance_{ZnO1-x}$ = 2.62 and $\eta_{ZnO1-x} = \eta_{Q.S}$ = 1.333 (water as a solvent)

S2. Quenching efficiency equation

The quenching efficiency (QE) of ferritin and all other interfering biomolecules was calculated using the equation below:

$$QE = \frac{(I_0 - I)}{I_0} \times 100$$

Where I_0 and I are the fluorescence intensities of ZnO_{1-x} nanosheets without and with analyte, respectively.

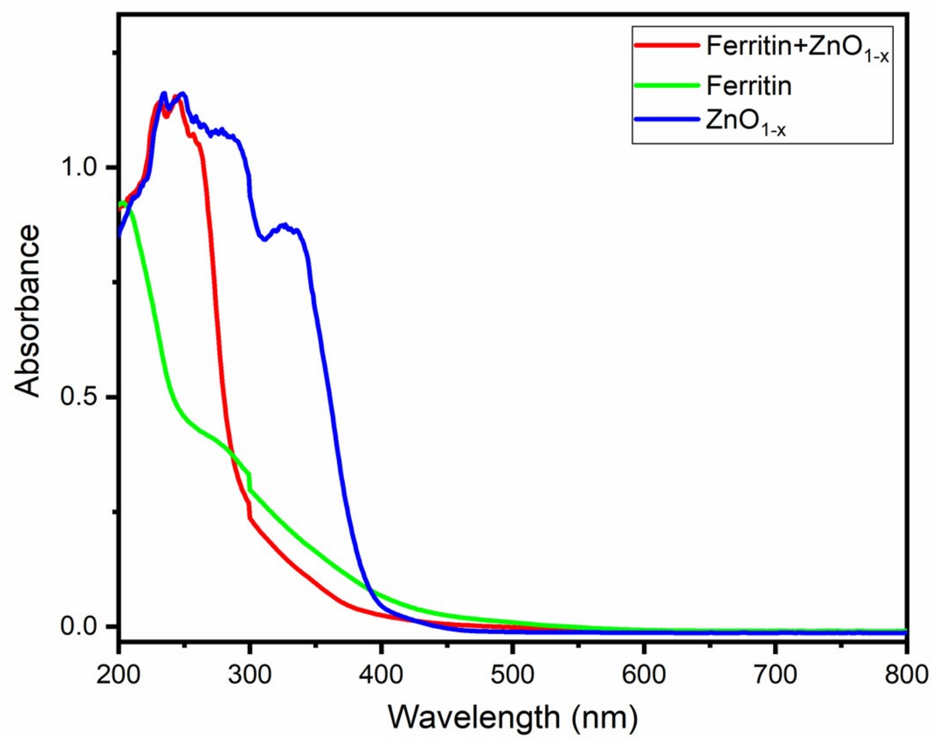

Fig. S6. UV-Vis absorption spectra for ferritin (green), bare ZnO_{1-x} (blue) and ZnO_{1-x} after addition of ferritin (red).

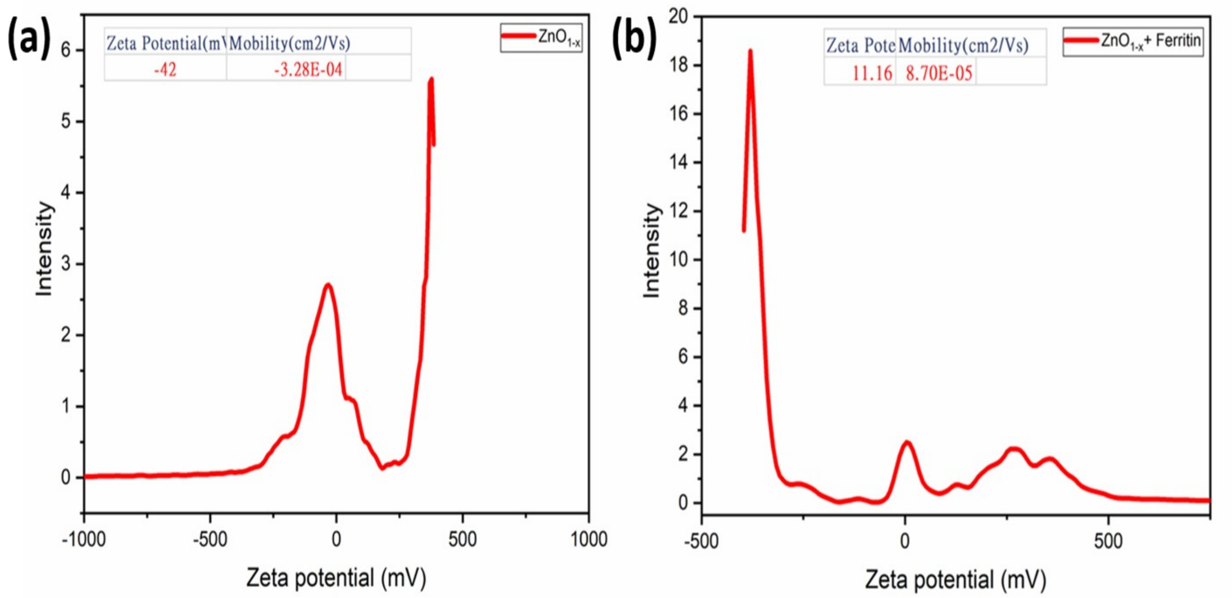

Fig. S7. Zeta potential studies for (a) ZnO_{1-x} nanosheets, (b) ZnO_{1-x} + Ferritin