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

Supporting Information:

Designed Synthesis of Unique Single-crystal Fe-doped $LiNiPO_4$ Nanomesh as the Enhanced Cathode for Lithium Ion Batteries

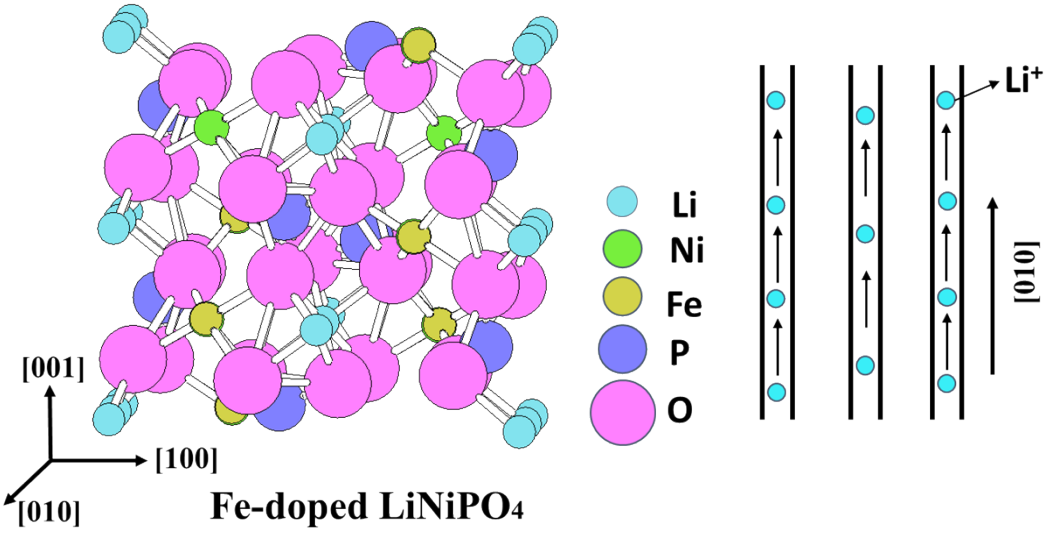

Figure S1. Schematic illustration of Fe-doped $LiNiPO_4$ and Li ion diffusion pathway along [010].

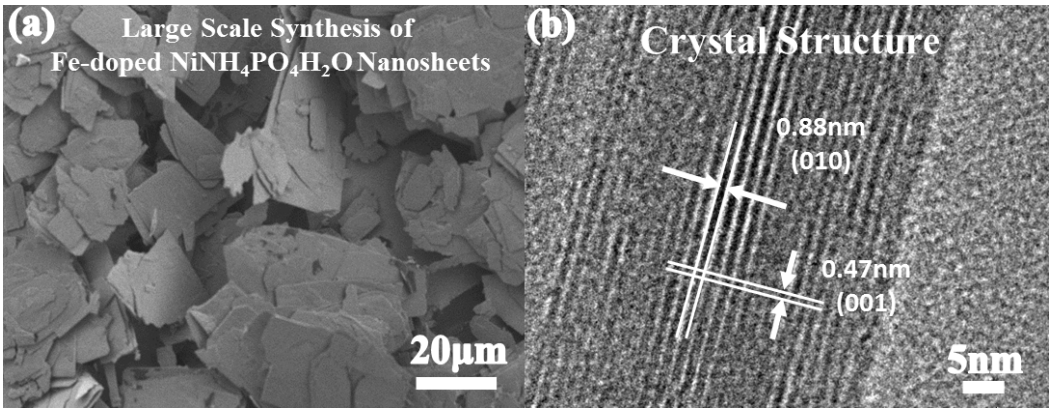

Figure S2. (a) SEM image and (b) HRTEM image of Fe-doped $NiNH_4PO_4 \cdot H_2O$ nanosheets.

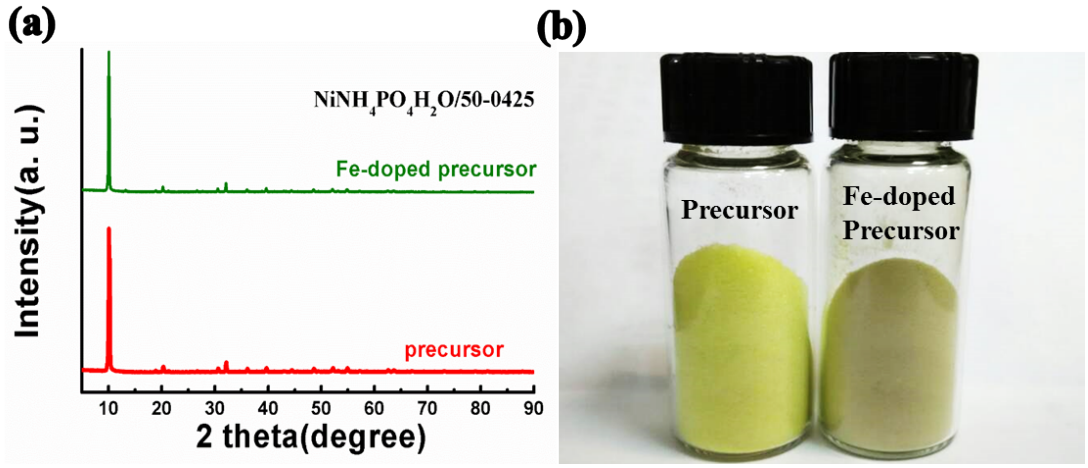

Figure S3. Comparison of $NiNH_4PO_4 \cdot H_2O$ and Fe-doped $NiNH_4PO_4 \cdot H_2O$. (a) XRD patterns and (b) Optical images of $NiNH_4PO_4 \cdot H_2O$ nanosheets before and after doping with Fe.

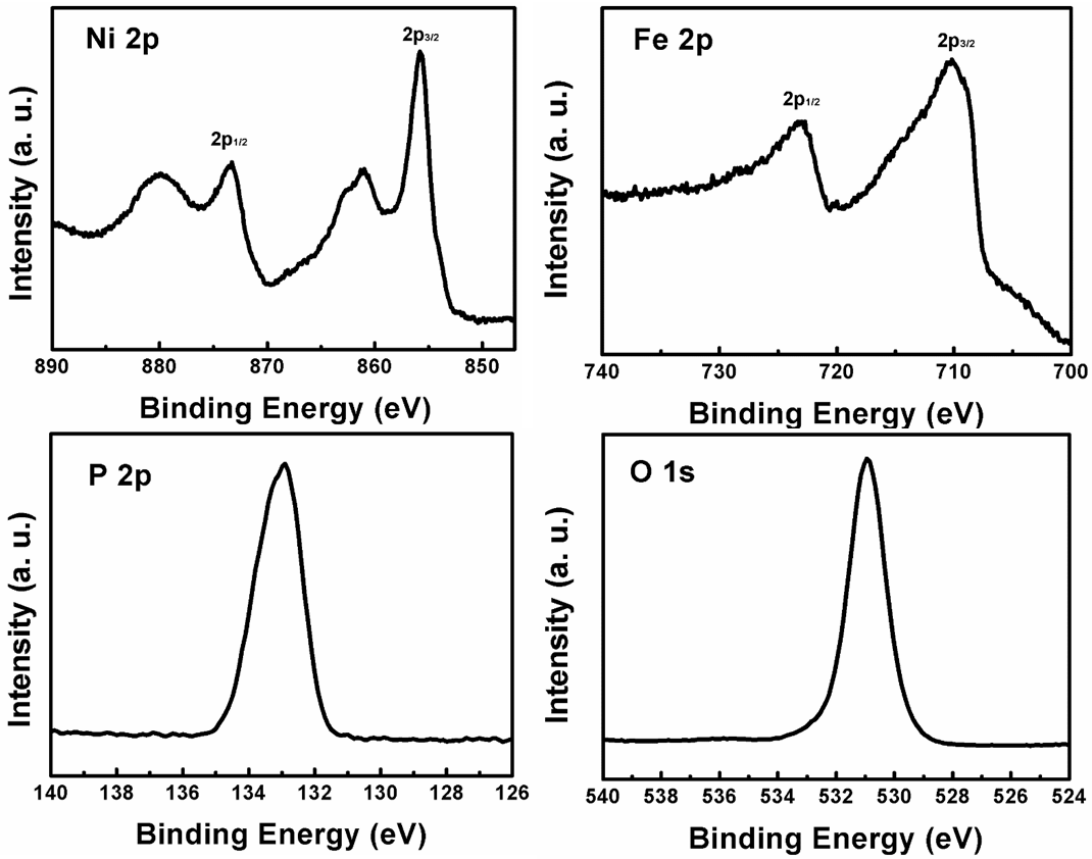

Figure S4. XPS spectra of (a) Ni 2p, (b) Fe 2p, (c) P 2p and (d) O 1s of the hierarchical Fe-doped $LiNiPO_4$ nanomesh.

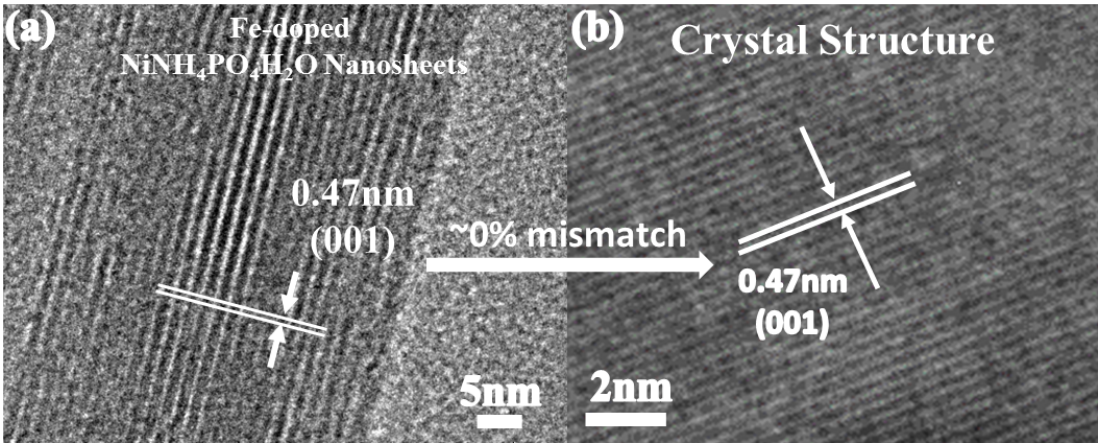

Figure S5. The schematics to introduce the mechanism through Fe-doped $NiNH_4PO_4 \cdot H_2O$ nanosheet to Fe-doped $LiNiPO_4$ nanomesh while maintaining the single crystal feature. From the calculation based on the (001) crystal plane of the precursor and the final samples, the crystal mismatch is close to 0%.

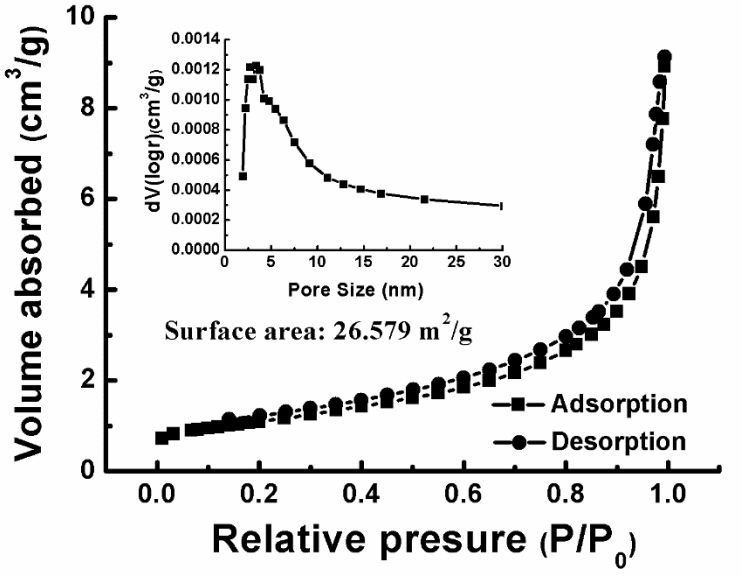

Figure S6. BET profile of the hierarchical $LiNiPO_4$ nanomesh.

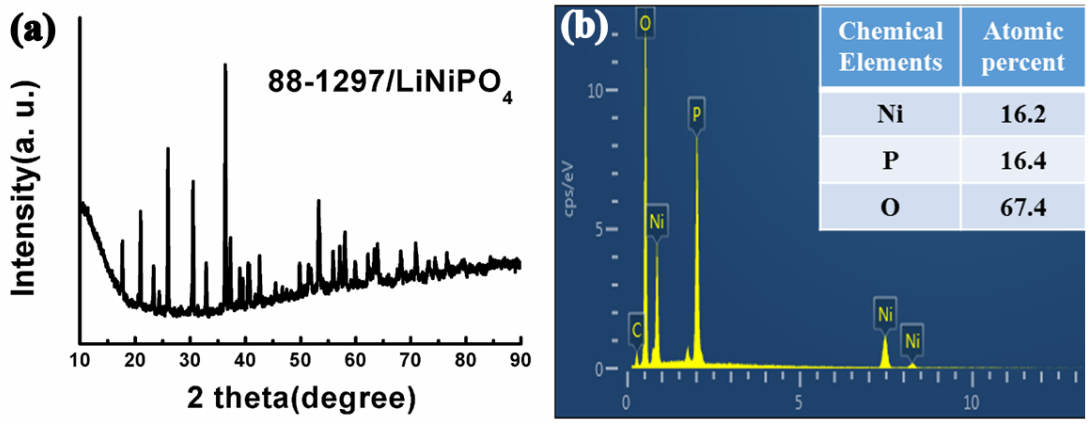

Figure S7. (a) XRD pattern of pure $LiNiPO_4$ nanomesh. (b) The corresponding EDS analysis.

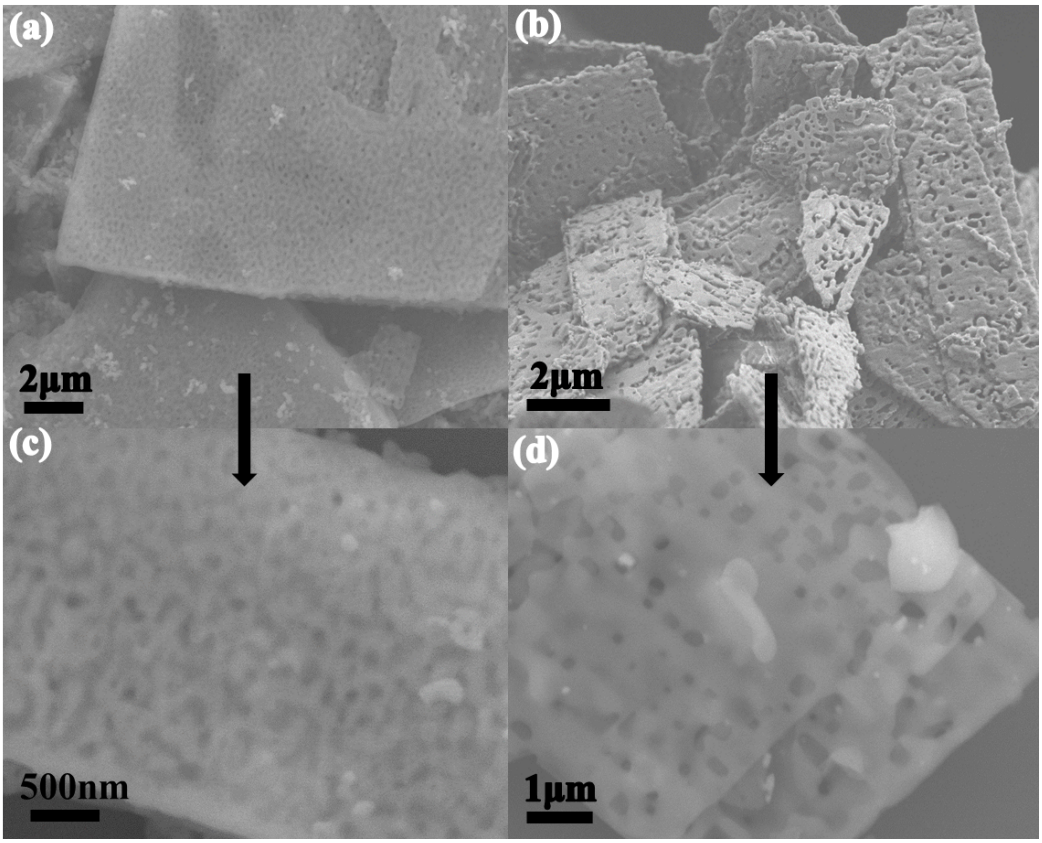

Figure S8. SEM images at different resolutions of Fe-doped $LiNiPO_4$ (a), (c) and $LiNiPO_4$ nanomesh (b), (d) for comparison.

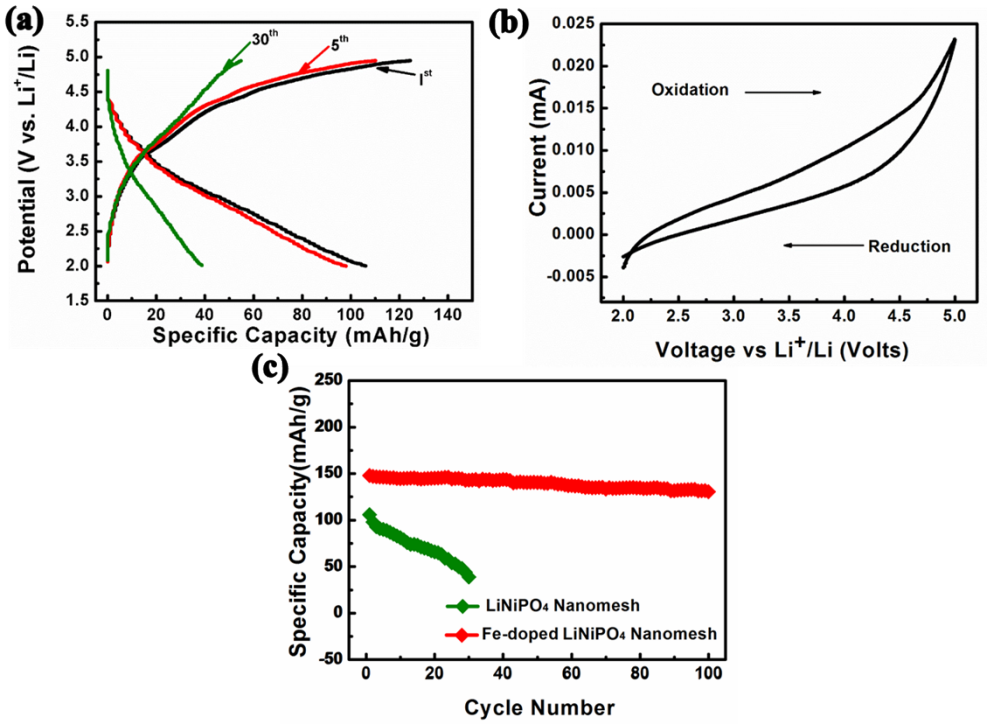

Figure S9. (a) The galvanostatic charge-discharge profiles of pure $LiNiPO_4$ nanomesh over 30 cycles at the rate of 0.1C. (b) CV profile of pure $LiNiPO_4$ nanomesh for 2.0-4.95 V. (c) Comparison of galvanostatic measurement of Fe-doped $LiNiPO_4$ and $LiNiPO_4$ nanomesh.

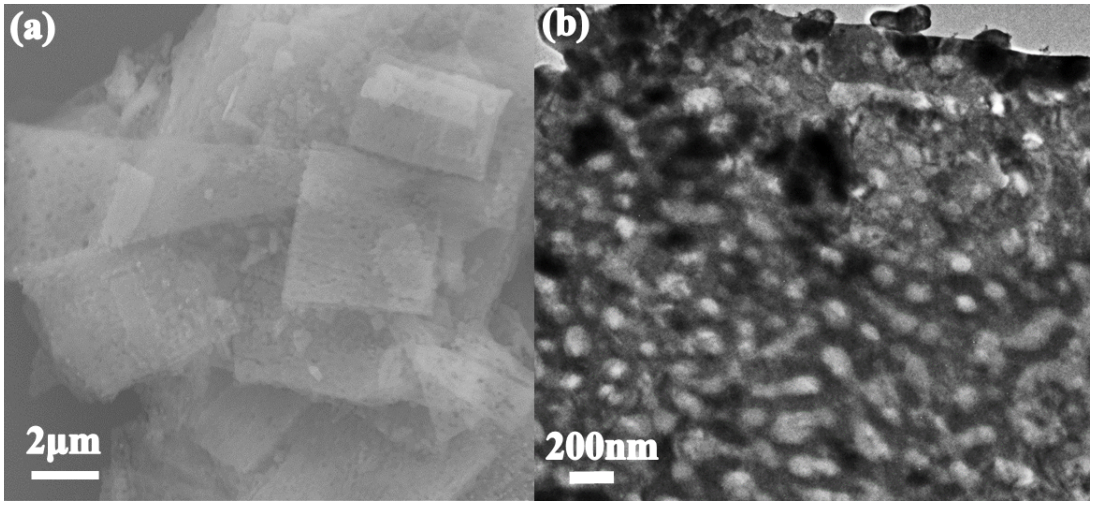

Figure S10. (a) SEM and (b) TEM images to clarify the well-maintained nanomesh structure after 100 cycles of galvanostatic charge-discharge.

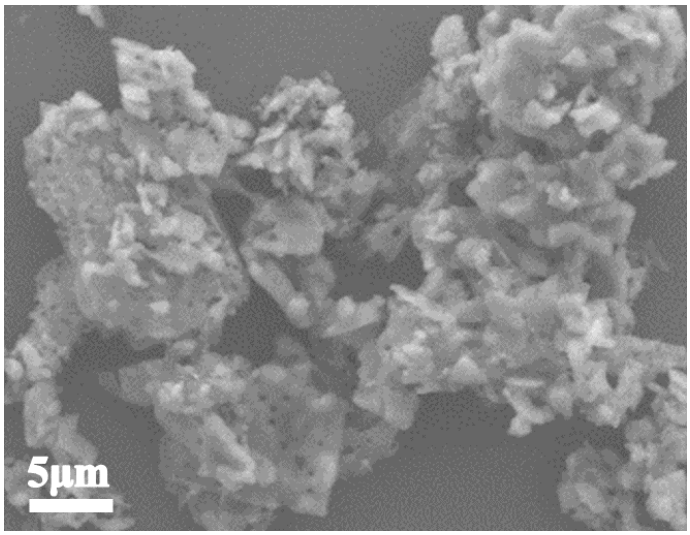

Figure S11. SEM image of $LiNiPO_4$ nanomesh after 30 cycles of galvanostatic charge-discharge.

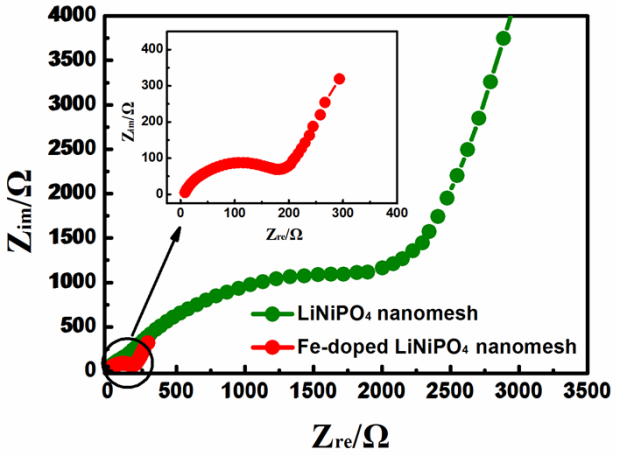

Figure S12. Comparison of AC impedance of Fe-doped $LiNiPO_4$ nanomesh (red dot line) and $LiNiPO_4$ nanomesh (green dot line) from 0.01Hz to 100 kHz.

Composite	Conductivity / S·cm^{-1} (298K)
$LiNiPO_4$	$3.24*10^{-8}$
Fe-doped $LiNiPO_4$	$5.02*10^{-7}$

Table S1. Conductivity of both $LiNiPO_4$ and Fe-doped $LiNiPO_4$ for comparison.