

Supporting Information for

**Robust Lithium-ion Anodes Based on Nanocomposites of Iron Oxide-
Carbon-Silicate**

Hiesang Sohn,^a Zheng Chen,^a Yoon Seok Jung,^b Qiangfeng Xiao,^c Mei Cai*,^c and Yunfeng Lu*,^a

^a Department of Chemical and Biomolecular Engineering, University of California, Los Angeles, CA 90095, USA, E-mail: luucla@ucla.edu; ^b Interdisciplinary School of Green Energy, Ulsan National Institute of Science and Technology (UNIST), Ulsan 689-798, Korea; ^c General Motors R&D Center, Warren, Michigan 48090, USA, E-mail: mei.cai@gm.com.

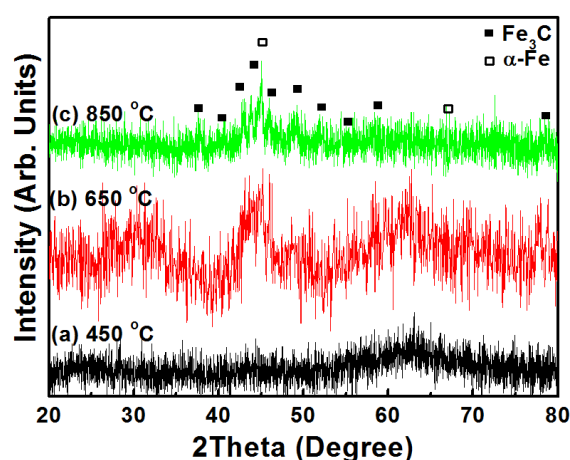


Figure S1. XRD patterns of mesoporous particles of (a) amorphous FeO_x (450 °C) and (b) Fe-FeO_x (650 °C) (c) α-Fe and Fe₃C (850 °C)

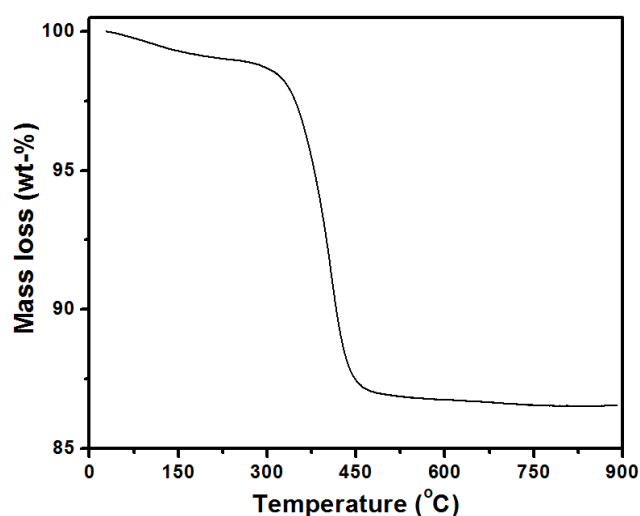


Figure S2. Thermogravimetric analysis of Fe₃O₄-C by thermo gravimetric analyzer in air atmosphere

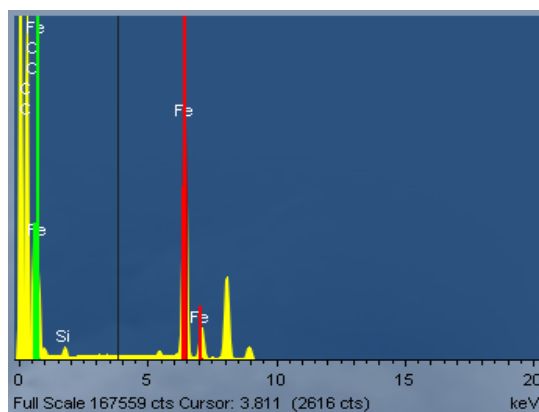


Figure S3. Elemental analysis for Fe₃O₄-C with energy dispersive X-ray spectroscopy (EDX)

Table S1. Elemental analysis of Fe₃O₄-C by EDX

Element	Peak Area	k factor	Abs Corr.	Weight %
C K	638047	1.915	1.237	50.0
O K	240990	1.570	1.253	15.6
Si K	23215	0.867	1.038	0.7
Fe K	997872	1.015	1.000	33.5

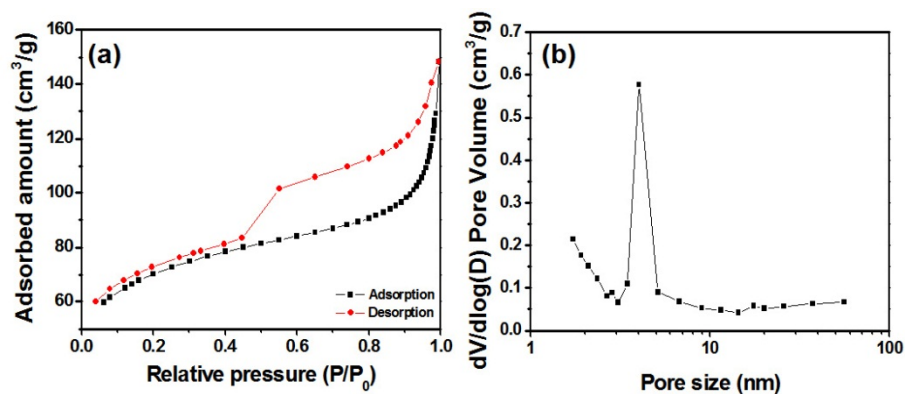


Figure S4. (a) N₂ sorption behavior (b) Pore size distribution (nm) of Fe₃O₄-C

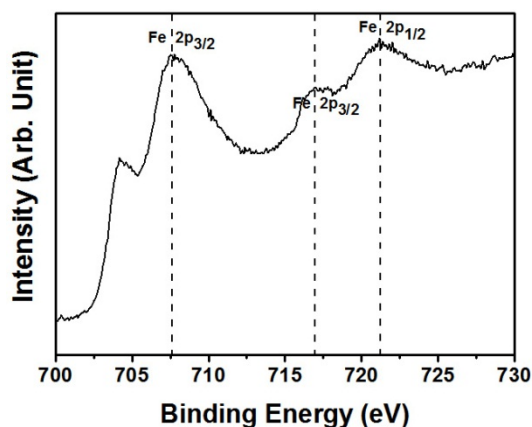


Figure S5. X-ray Photoelectron spectroscopy (XPS) of Fe-FeO_x-C

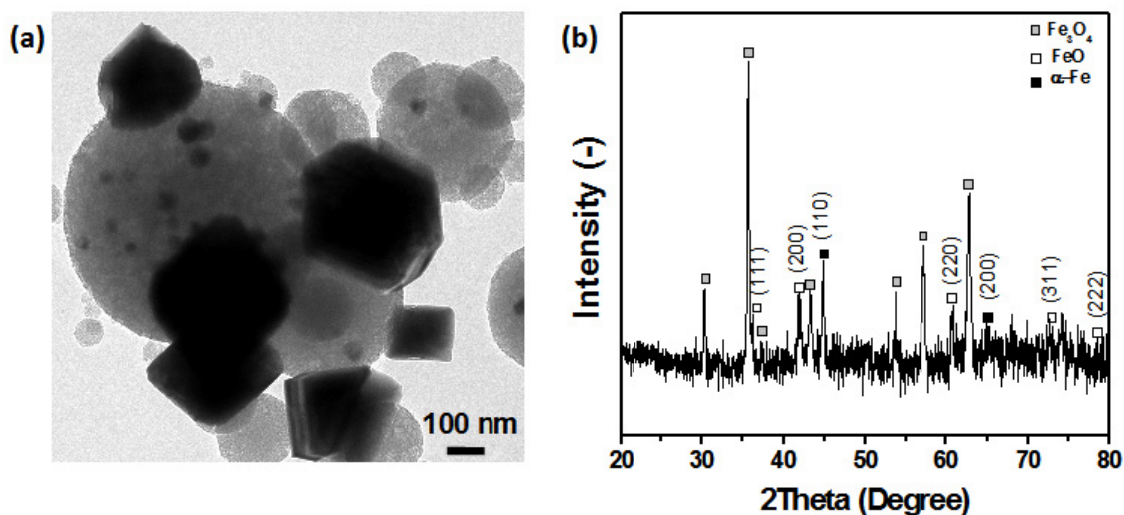


Figure S6. (a) TEM image and (b) XRD of FeO_x-C (without carbon-silicate coating) after sintering (indexed for FeO and Fe)

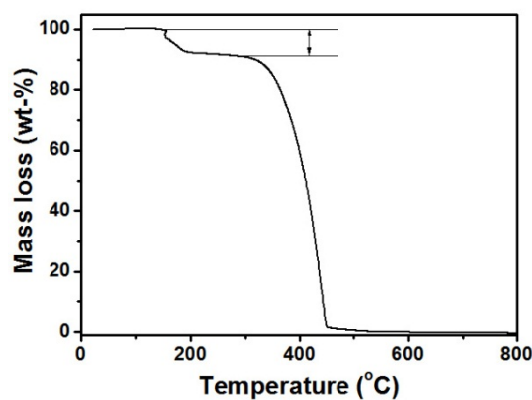


Figure S7. Thermal analysis for DPSD by thermo gravimetric analyzer in Ar atmosphere (inset arrow shows the mass loss by water evaporation caused by condensation reaction of DPSD)

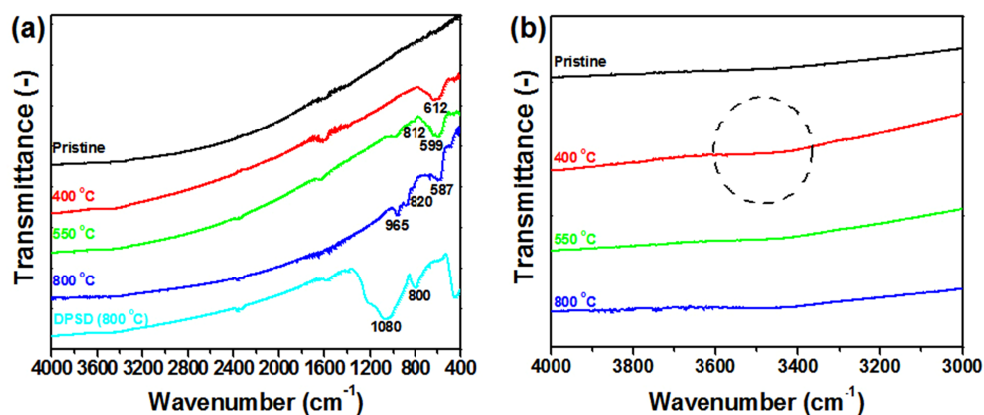


Figure S8. FT-IR spectra for Fe₃O₄-C subjected to different stage of sintering (a) full range (b) Silanol (Si-OH) and OH spectra (in circle)

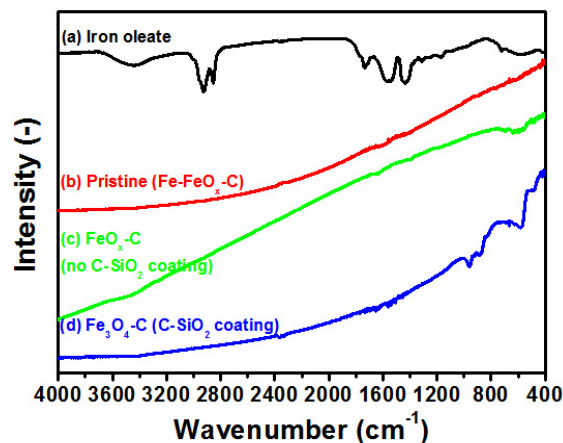


Figure S9. FT-IR spectra for (a) iron oleate, iron oxide-carbon composite of (b) as-prepared: (Fe-FeO_x-C: pristine) and after sintering: (c) FeO_x-C (sintering without carbon-silicate coating) and (d) Fe₃O₄-C (sintering with carbon-silicate coating)

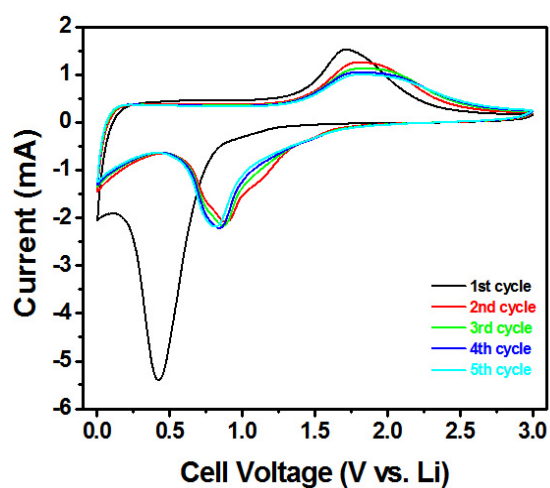


Figure S10. Cyclic voltammograms of the Fe₃O₄-C composite electrode at scan rate of 0.2 mV/s in a voltage window between 0.005 to 3.000 V.

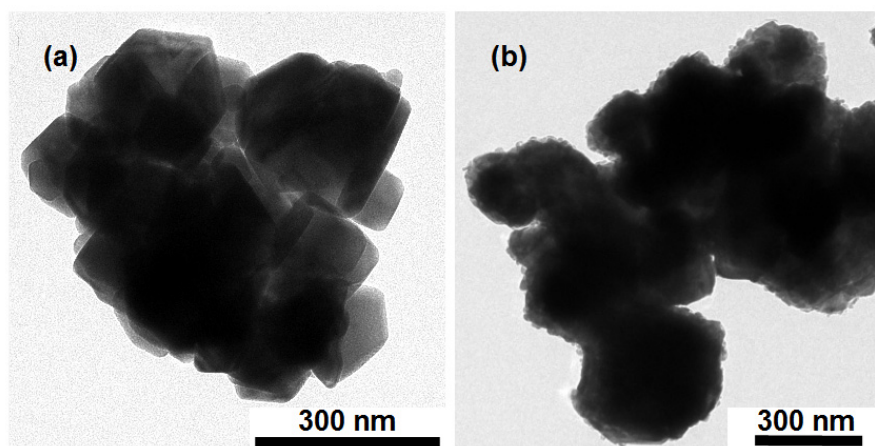


Figure S11. TEM images of (a) Fe₃O₄ NP (b) Coated-Fe₃O₄ NP

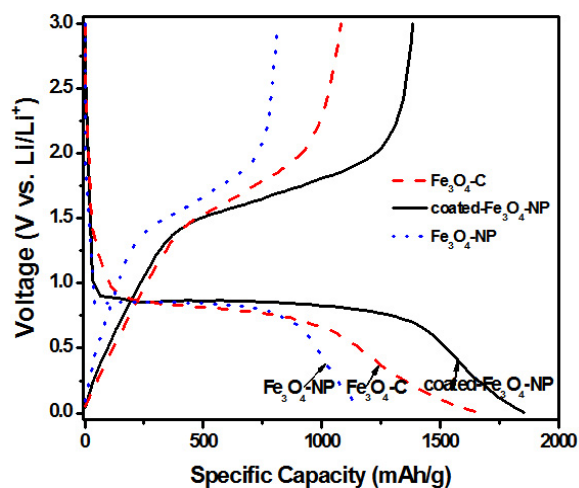


Figure S12. Voltage profiles for iron oxides ($\text{Fe}_3\text{O}_4\text{-C}$, $\text{Fe}_3\text{O}_4\text{-NP}$, coated- $\text{Fe}_3\text{O}_4\text{-NP}$) at a cycling rate of 0.13 A/g

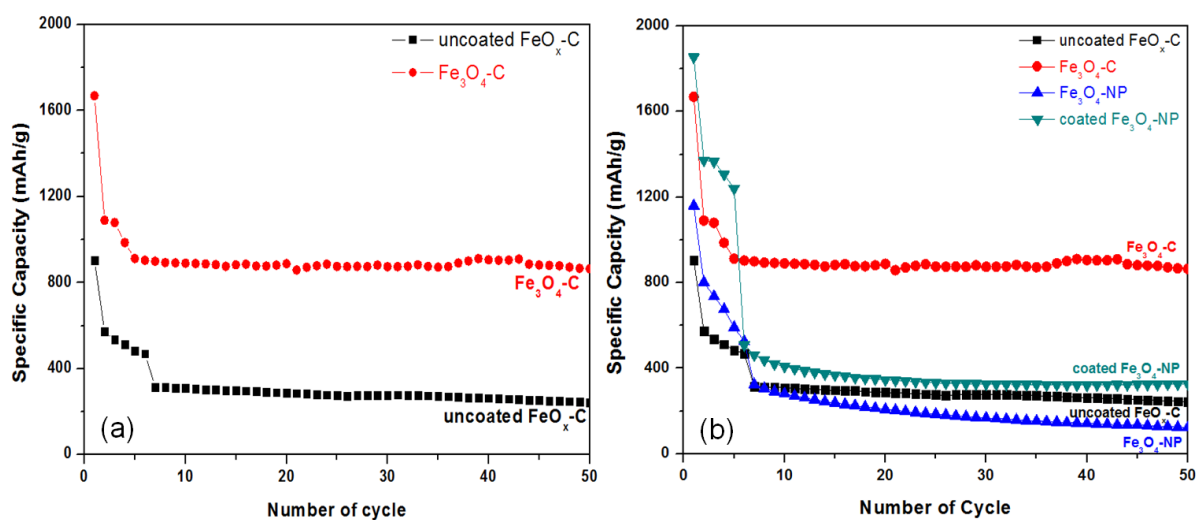


Figure S13. Cycling performance of iron oxide and carbon composites with different treatment (a) $\text{FeO}_x\text{-C}$ (uncoated one) and $\text{Fe}_3\text{O}_4\text{-C}$ (coated one) (b) comparison of all: $\text{Fe}_3\text{O}_4\text{-C}$ (coated one); $\text{FeO}_x\text{-C}$ (uncoated one); coated- $\text{Fe}_3\text{O}_4\text{-NP}$; $\text{Fe}_3\text{O}_4\text{-NP}$