

Supporting information

# Synthesis of Cobalt Phosphides and Their Application as Anodes for Lithium Ion Batteries

*Dan Yang,<sup>†‡</sup> Jixin Zhu,<sup>†‡</sup> Xianhong Rui,<sup>†⊥</sup> Huiteng Tan,<sup>†</sup> Ren Cai,<sup>⊥</sup> Harry E. Hoster,<sup>‡</sup> Denis*

*Y. W. Yu,<sup>‡§</sup> Huey Hoon Hng,<sup>†</sup> Qingyu Yan<sup>†‡§\*</sup>*

<sup>†</sup>School of Materials Science and Engineering, Nanyang Technological University, Singapore

639798, Singapore, <sup>‡</sup>TUM CREATE Research Centre@NTU, Nanyang Technological

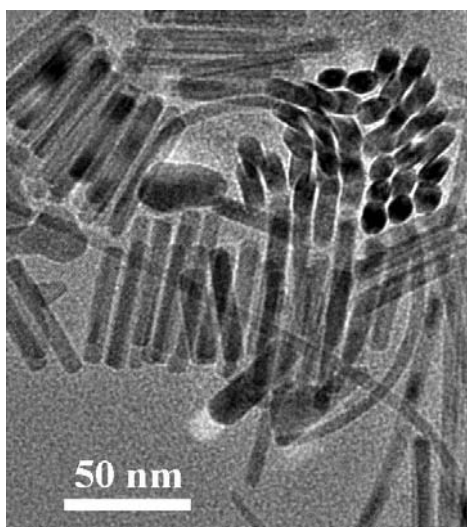
University, Singapore 637459, Singapore, <sup>§</sup>Energy Research Institute@NTU, Nanyang

Technological University, Singapore 637553, Singapore, <sup>⊥</sup>School of Civil and Environmental

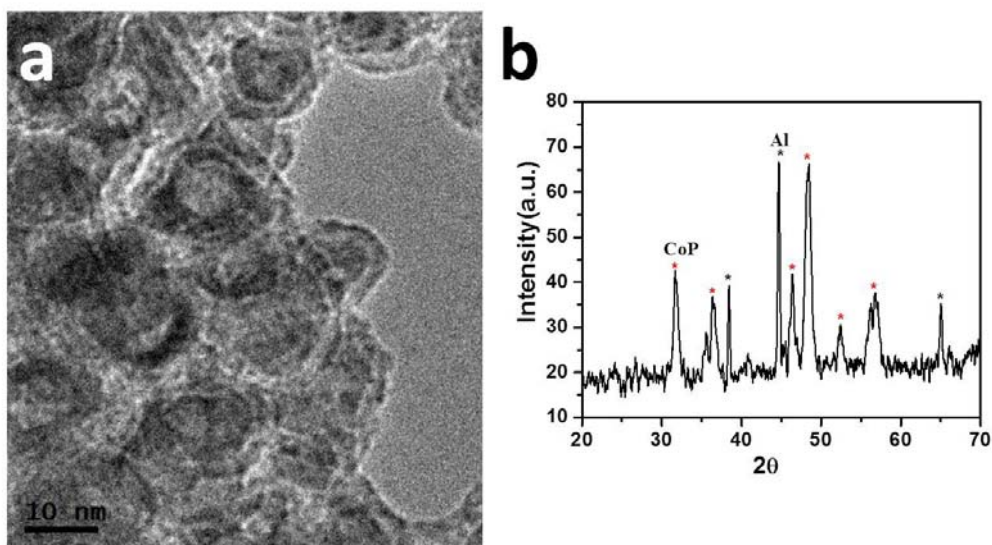
Engineering, Nanyang Technological University, Singapore 639798, Singapore

\*Author to whom correspondence should be addressed. Tel: (+65) 67904583; Fax: (+65)

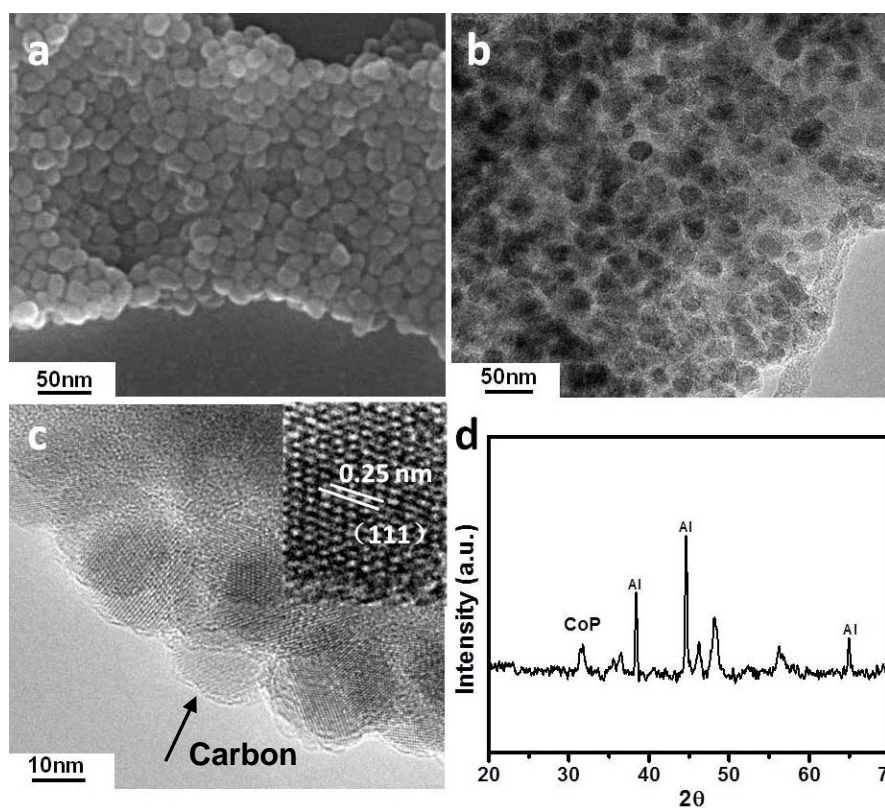
67909081. E-mail: [alexyan@ntu.edu.sg](mailto:alexyan@ntu.edu.sg).



**Figure S1:** TEM image of the Co<sub>2</sub>P nanorods and Co<sub>2</sub>P and CoP mixture obtained at 320 °C for 3 hours

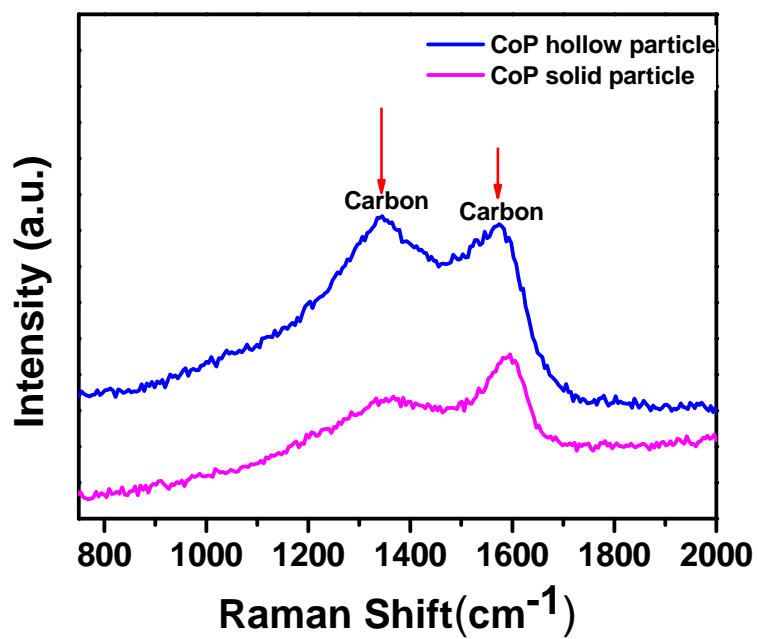


**Figure S2:** (a) TEM image for CoP hollow sphere after annealing at 450 °C under argon atmosphere for 2 hours and (b) its corresponding XRD pattern

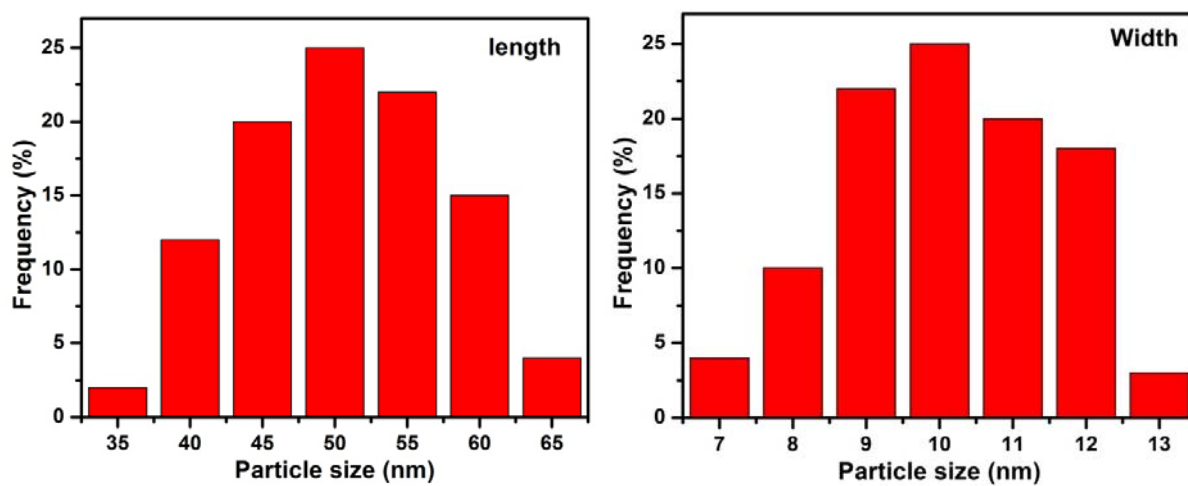
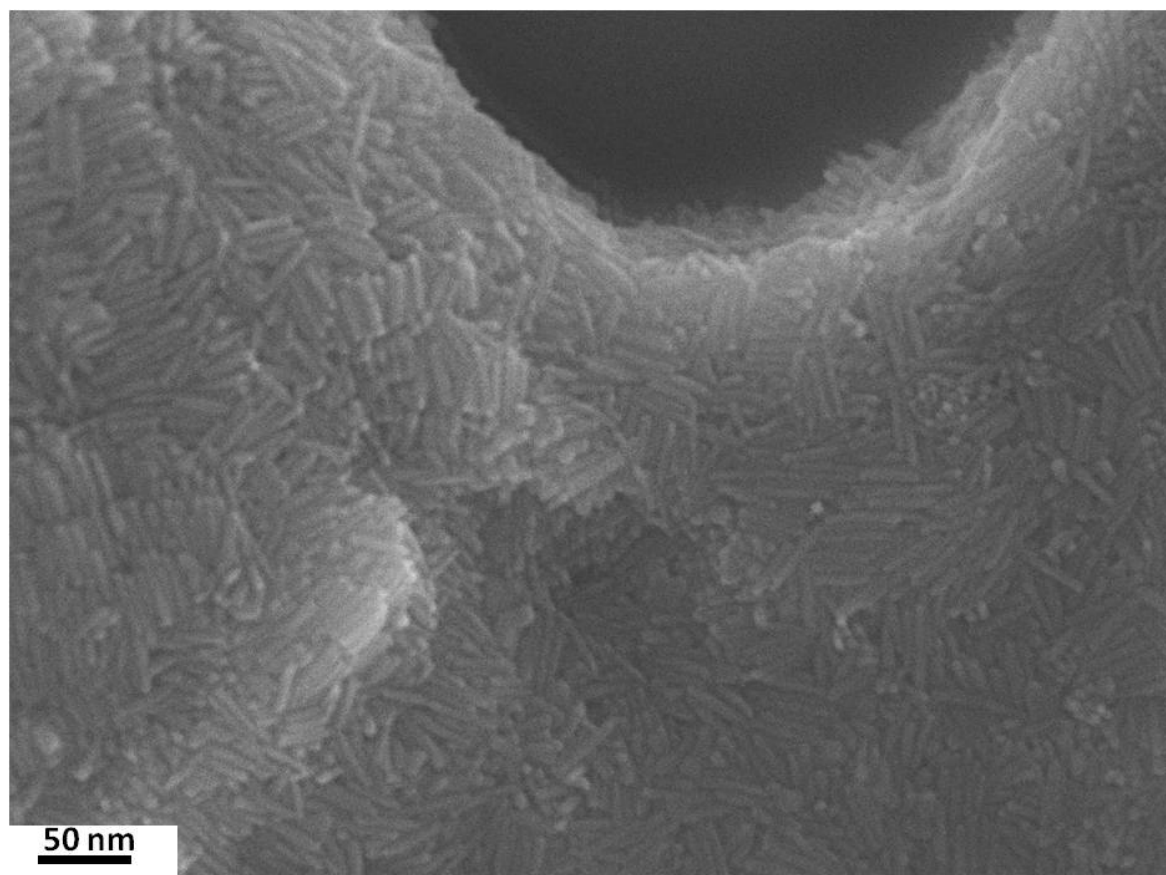


**Figure S3:** (a) FESEM image for solid CoP nanoparticle, with an average size around 20 nm; (b) The TEM image for the solid CoP; (c) HRTEM image of solid CoP, with the lattice distance 0.25 nm corresponding to the (111) plane; (d) The XRD pattern of CoP after annealing.

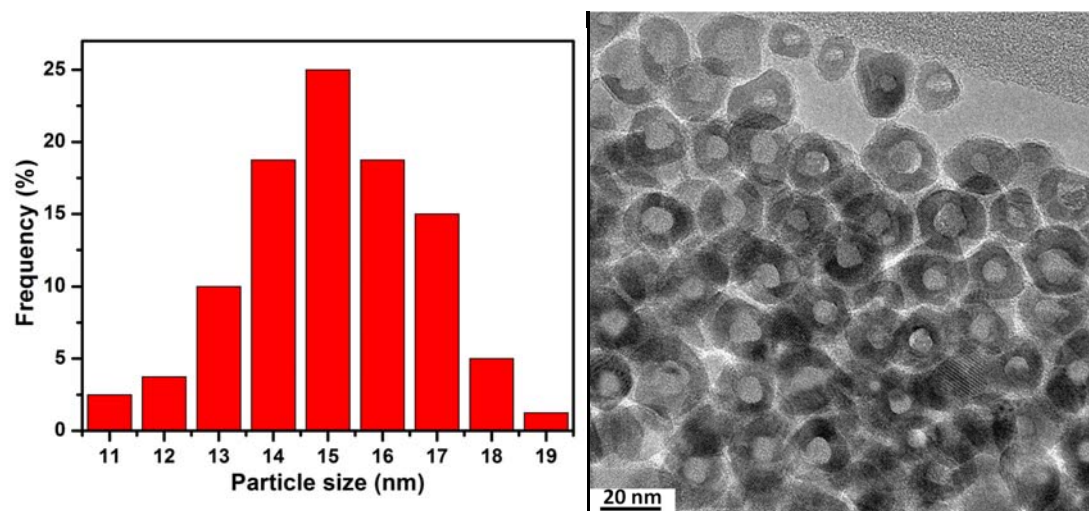
For the preparation of CoP solid nanoparticles, 10 mL TOP, 10 mL oleylamine and 1 mmol Co (acac)<sub>2</sub> were mixed at room temperature and then the mixture was heated to about 320 °C and kept for 1 hour. The as-obtained products were washed before characterization following similar procedure as that described in the Experiment section.



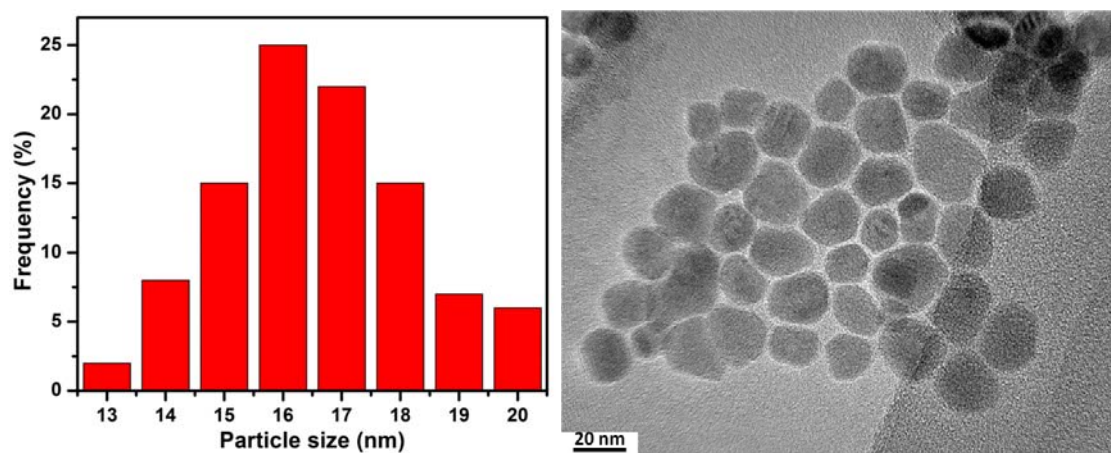
**Figure S4:** Raman Spectra for annealed CoP hollow and solid nanoparticles



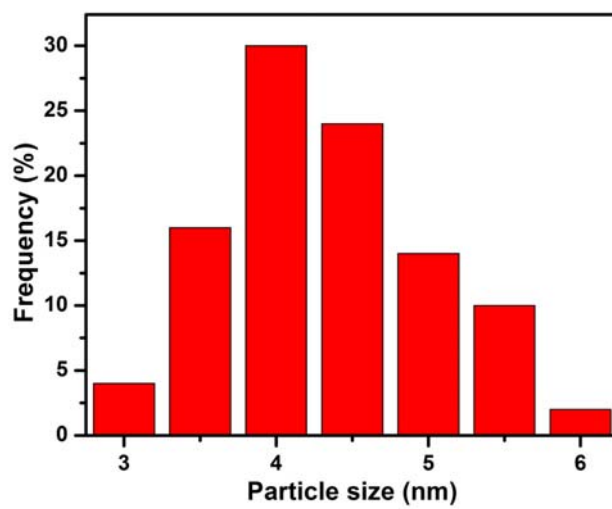
**Figure S5:** SEM image, size distribution histogram for the length and width of the Co<sub>2</sub>P nanorods shown in Figure 1a.



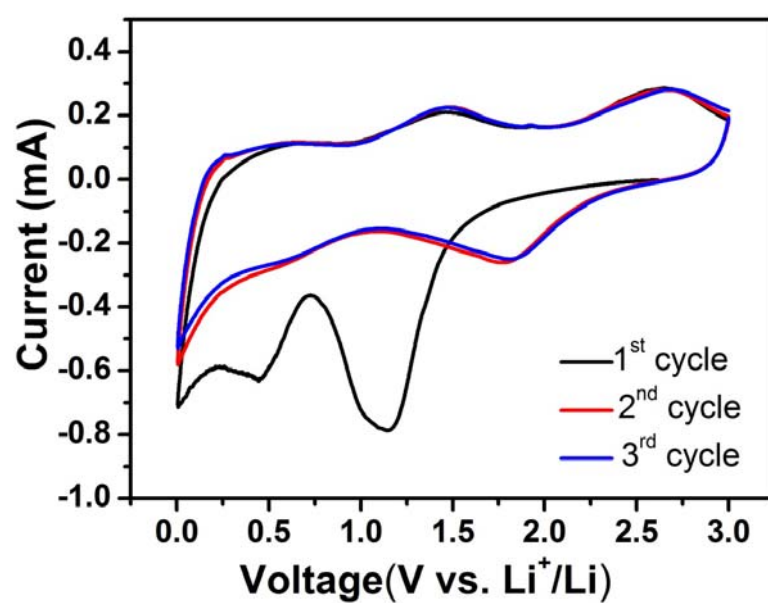
**Figure S6:** The size distribution histogram of hollow CoP nanoparticles.



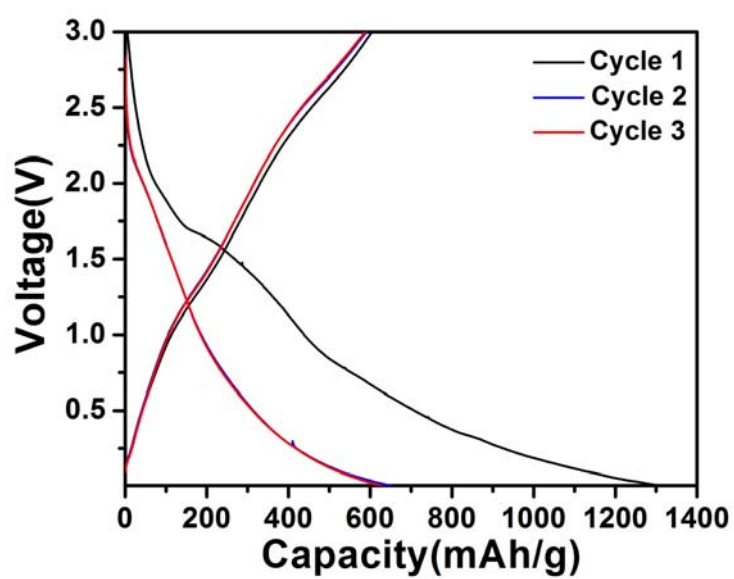
**Figure S7:** The size distribution histogram of solid CoP nanoparticles.



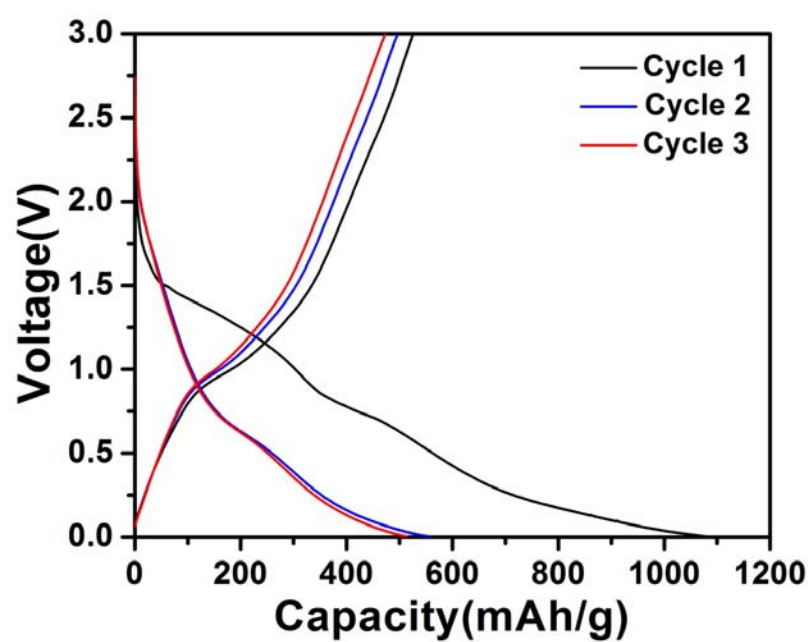
**Figure S8:** The size distribution histogram of fine CoP nanoparticles of 20 h reaction (refer to Figure 1c in the manuscript).



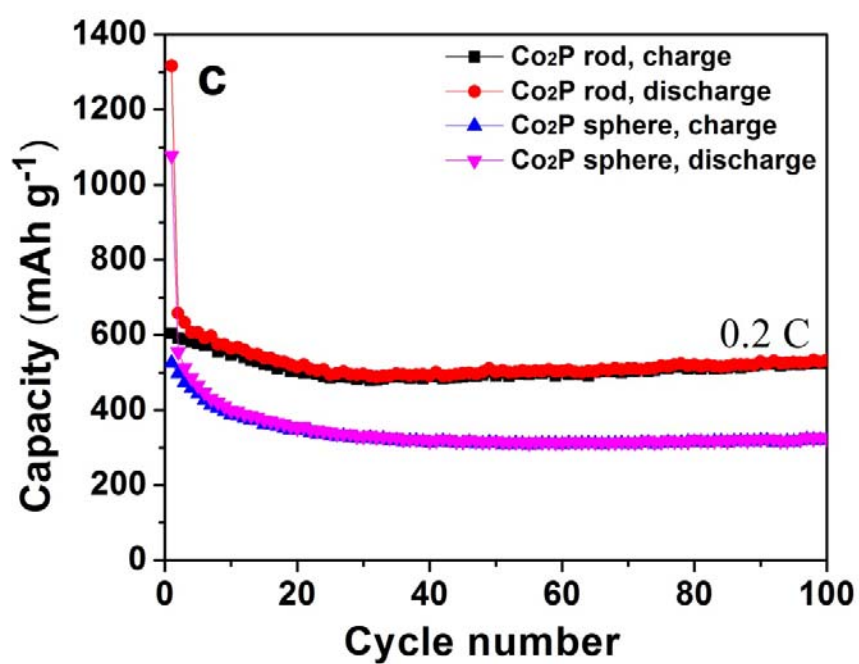
**Figure S9:** Cyclic voltammograms (CVs) of the first three cycles of Co<sub>2</sub>P nanorod obtained between 0 - 3.0 V at a scan rate of 0.5 mv/s.



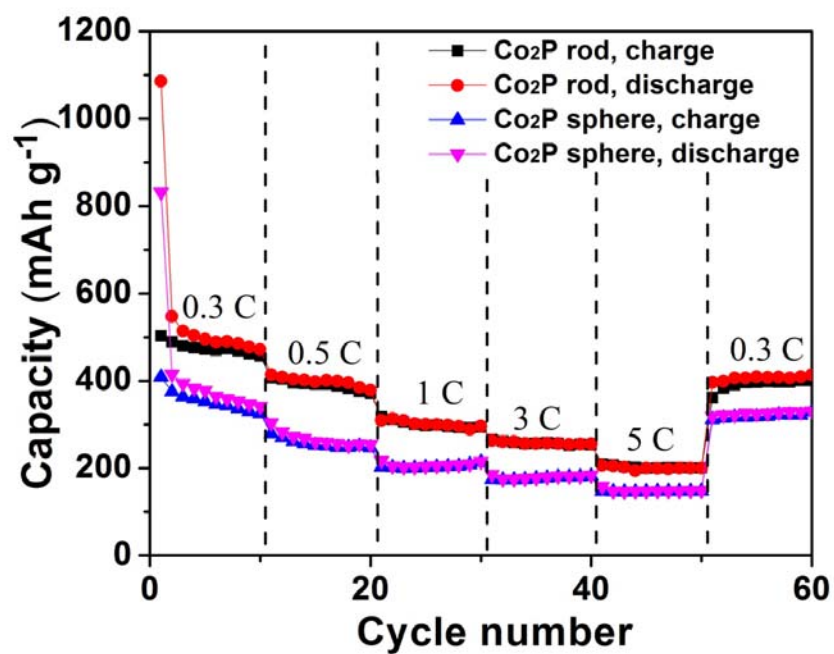
**Figure S10:** The Charge/discharge voltage profiles of Co<sub>2</sub>P nanorods between 0.005 and 3 V (vs Li<sup>+</sup>/Li) at a current density of 0.2 C.



**Figure S11:** The Charge/discharge voltage profiles of Co<sub>2</sub>P nanospheres between 0.005 and 3 V (vs Li<sup>+</sup>/Li) at a current density of 0.2 C.



**Figure S12:** Charge/discharge cycling performance of Co<sub>2</sub>P rods and spheres between 0.005-3 V (vs Li<sup>+</sup>/Li) at a current density of 0.2 C.



**Figure S13:** Comparison of charge and discharge capacities of them at different current rates between 0.005-3V.