

Porous Layered Stacked MnCo₂O₄ Cubes with Enhanced Electrochemical Capacitive Performance

Menggang Li¹, Weiwei Yang,^{1*} Ji Li,³ Ming Feng,³ Weili Li,^{2*} and Haibo Li³

Yongsheng Yu^{1*}

¹MIIT Key Laboratory of Critical Materials Technology for New Energy Conversion and Storage, School of Chemistry and Chemical Engineering, Harbin Institute of Technology, Harbin, Heilongjiang 150001, China

²School of Materials Science and Engineering, Harbin Institute of Technology, Harbin 150001, China

³Key Laboratory of Functional Materials Physics and Chemistry of the Ministry of Education, Jilin Normal University, Changchun 130103, China

*To whom correspondence should be addressed. Email: yangww@hit.edu.cn, ysyu@hit.edu.cn and wlli@hit.edu.cn

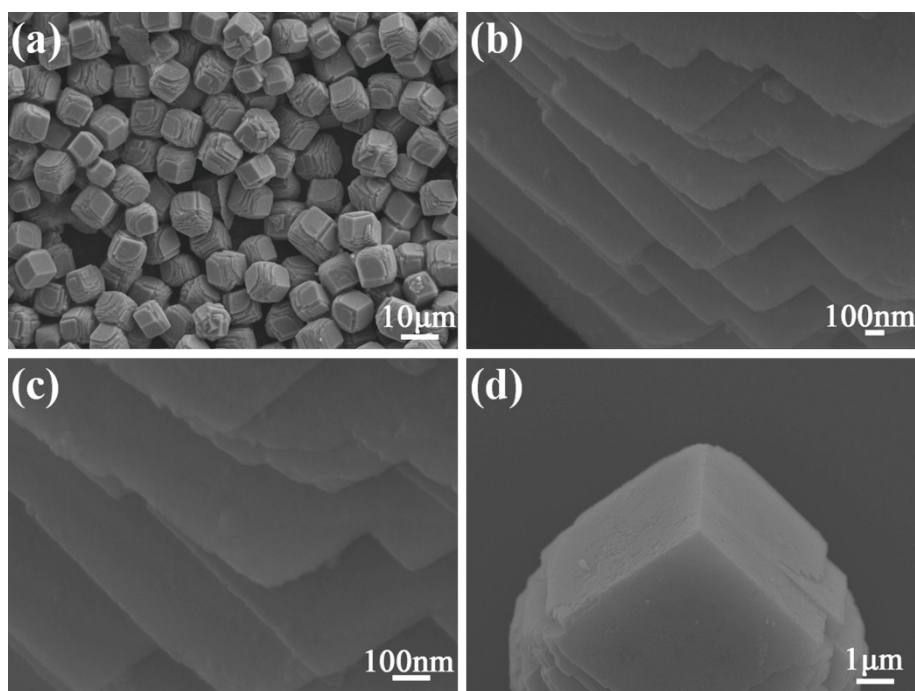


Figure S1. SEM images of $\text{MnCo}_2(\text{CO}_3)_3$ with different magnifications.

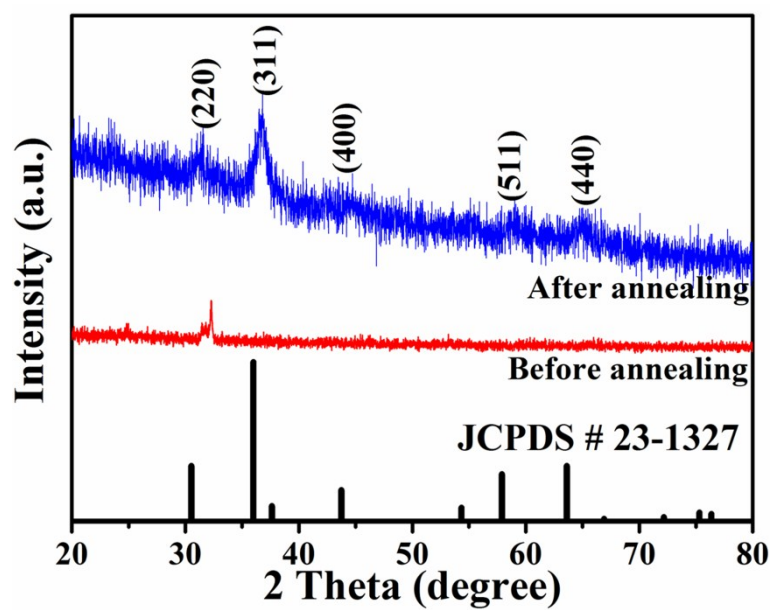


Figure S2. XRD patterns of the MnCo_2O_4 before and after annealing.

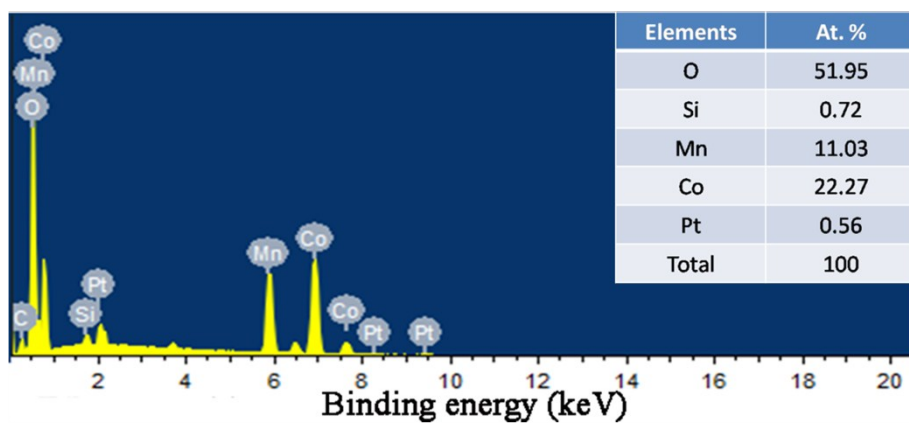


Figure S3. EDS analysis of porous layered stacked MnCo_2O_4 cube.

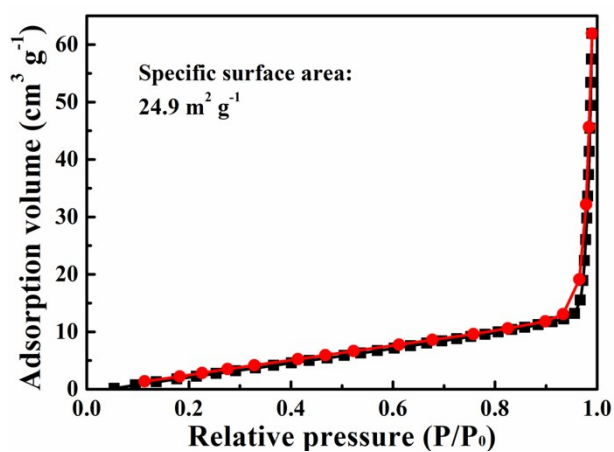


Figure S4. Nitrogen adsorption-desorption isotherms curves of $\text{MnCo}_2(\text{CO}_3)_3$.

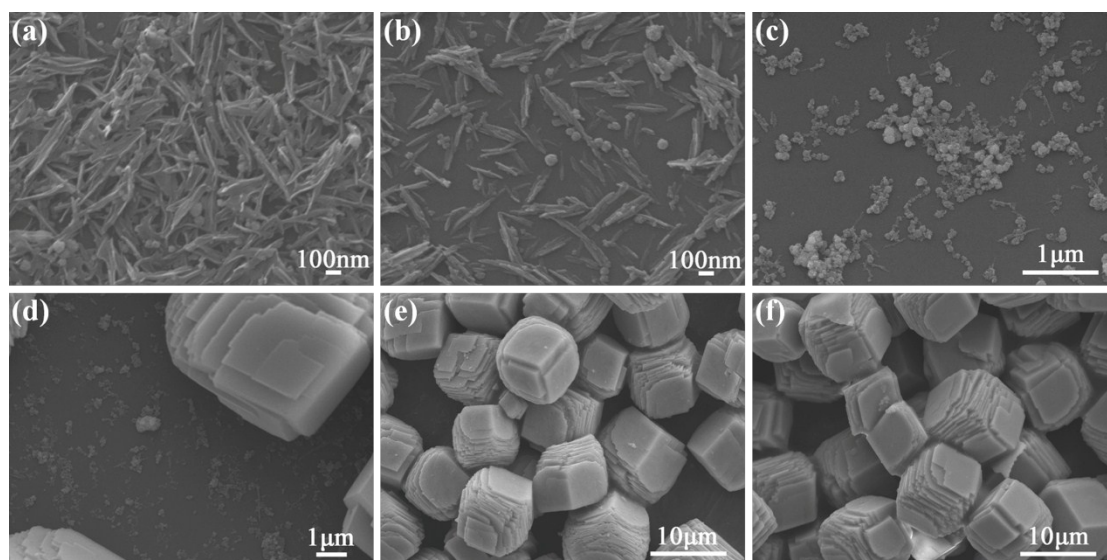


Figure S5. SEM images of the $\text{MnCo}_2(\text{CO}_3)_3$ taken from different reaction times. (a) 0.5 h, (b) 1.0 h, (c) 2.5 h, (d) 4.0 h, (e) 5.5 h, (f) 7.0 h.

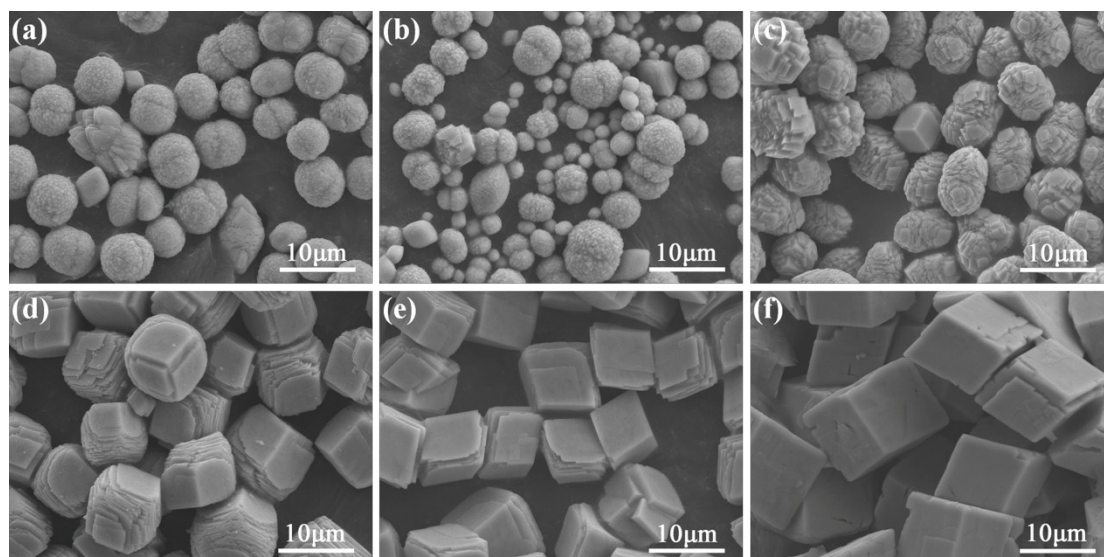


Figure S6. SEM images of $\text{MnCo}_2(\text{CO}_3)_3$ taken from different ratios of $\text{Mn}^{2+}/\text{Co}^{2+}$. $\text{Mn}^{2+}/\text{Co}^{2+} =$ (a) 14 : 1, (b) 4 : 1, (c) 1 : 1, (d) 1 : 2, (e) 1 : 4 and (f) 1 : 14.

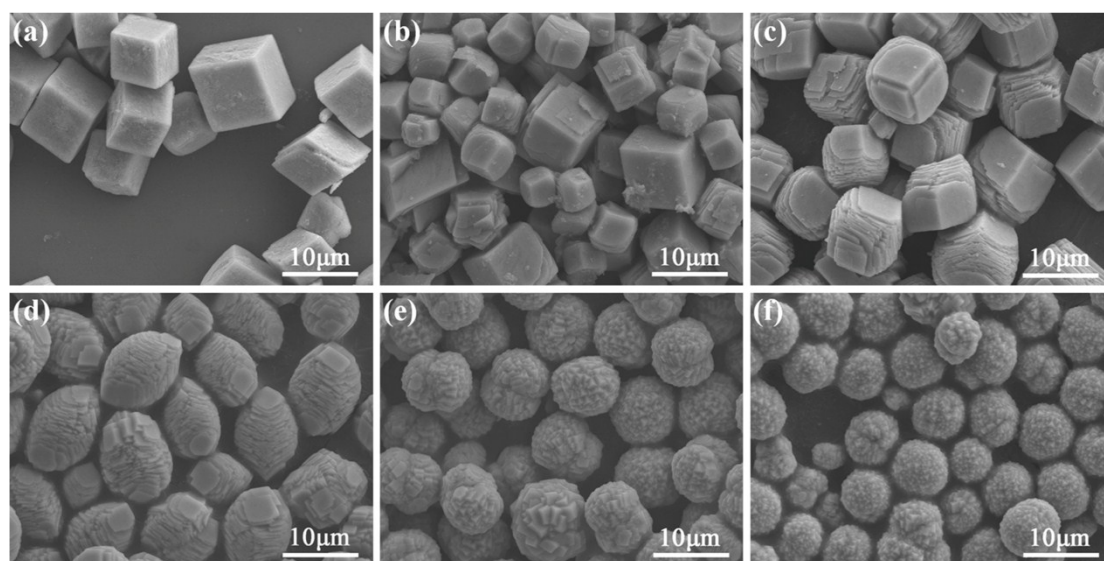


Figure S7. SEM images of MnCo_2O_4 via the different amount of reactants. $n(\text{Mn}^{2+}) : n(\text{Co}^{2+}) =$ (a) 0.05 mmol : 0.1 mmol, (b) 0.1 mmol : 0.2 mmol, (c) 0.25 mmol : 0.5 mmol, (d) 0.5 mmol : 1.0 mmol, (e) 1.0 mmol : 2.0 mmol and (f) 1.5 mmol : 3.0 mmol.

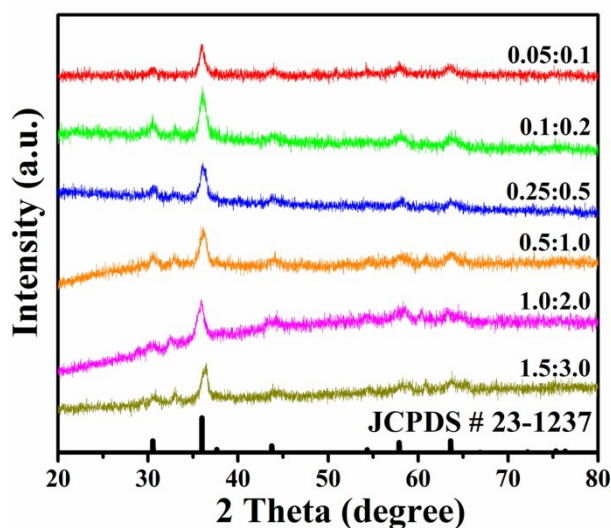


Figure S8. XRD patterns of various morphologies of MnCo_2O_4 via different amount of precursors.

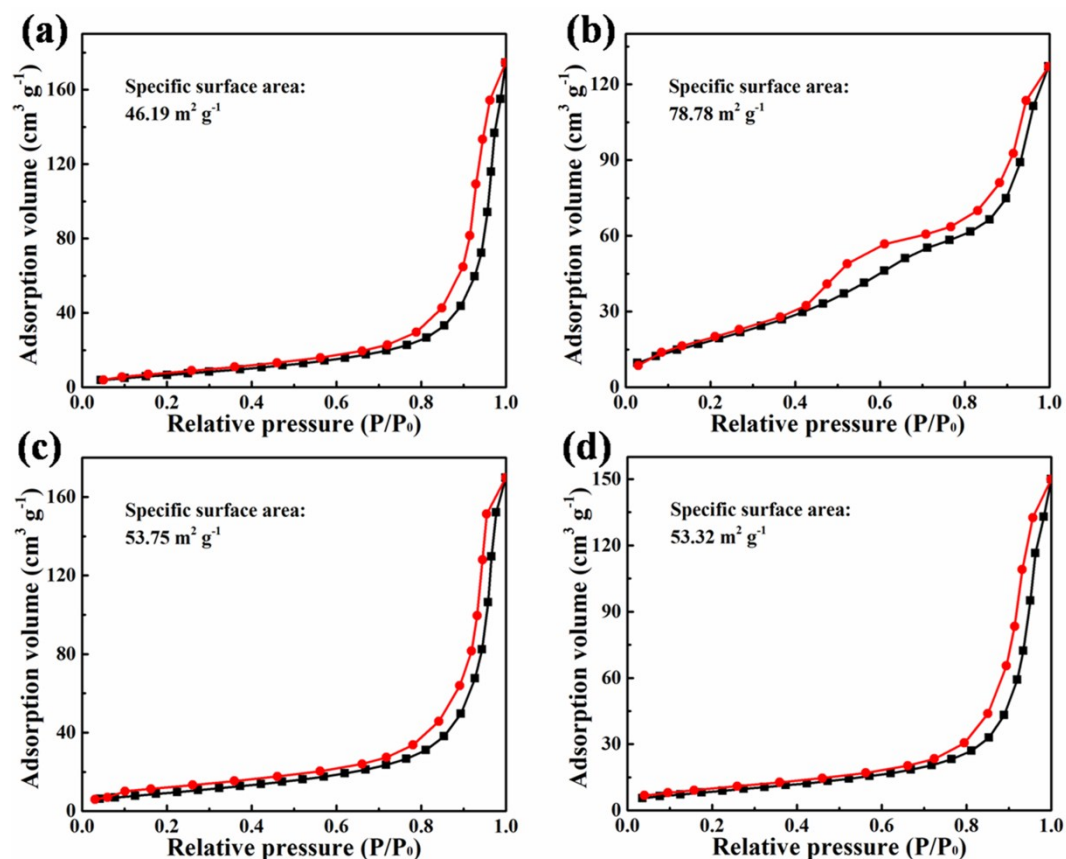


Figure S9. Nitrogen adsorption-desorption isotherms curves of MnCo_2O_4 via different amount of precursors. $n(\text{Mn}^{2+}) : n(\text{Co}^{2+}) =$ (a) 0.1 mmol : 0.2 mmol, (b) 0.5 mmol : 1.0 mmol, (c) 1.0 mmol : 2.0 mmol and (d) 1.5 mmol : 3.0 mmol.

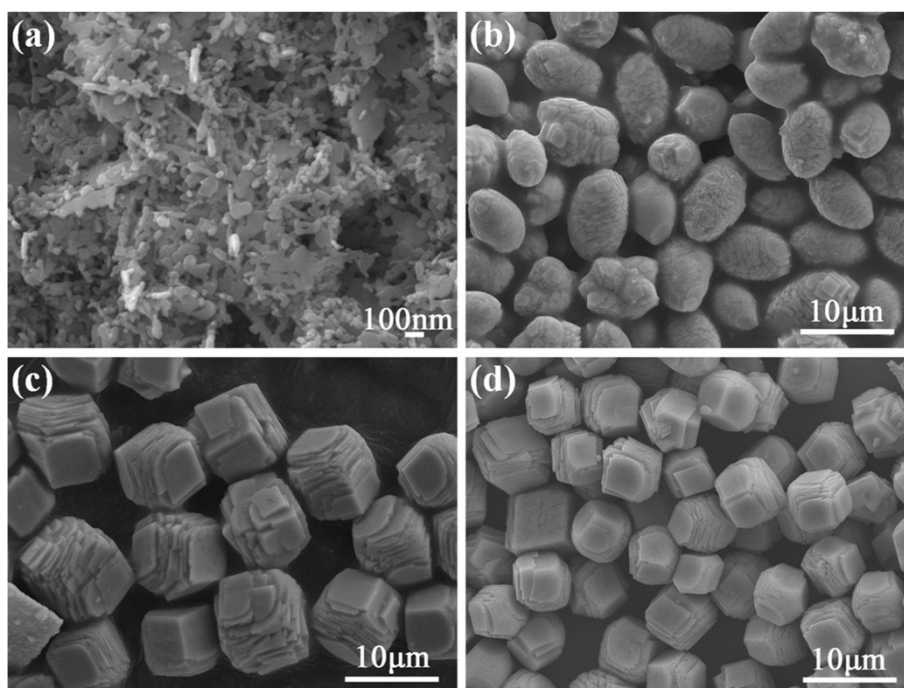


Figure S10. SEM images of MnCo_2O_4 via different synthesis temperature. The synthesis temperature: (a) 90 °C, (b) 120 °C, (c) 180 °C and (d) 210 °C.

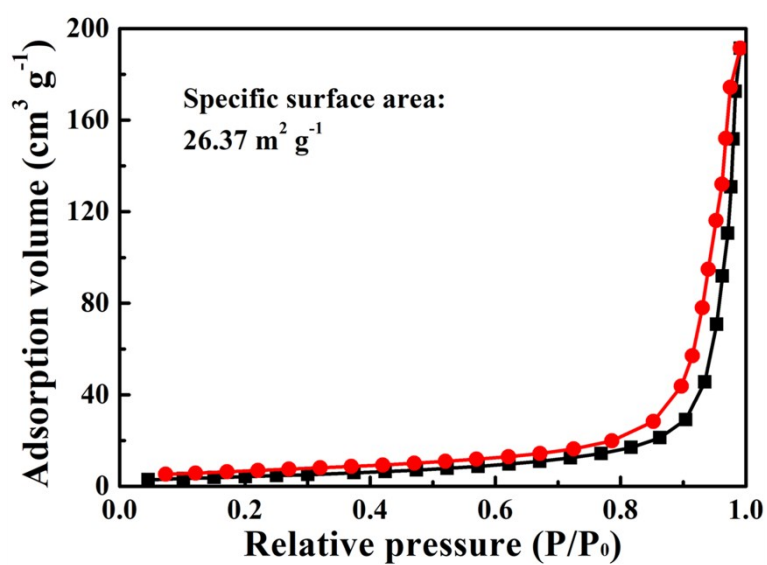


Figure S11. Nitrogen adsorption-desorption isotherms curves of MnCo_2O_4 with the synthesis temperature of 90 °C.

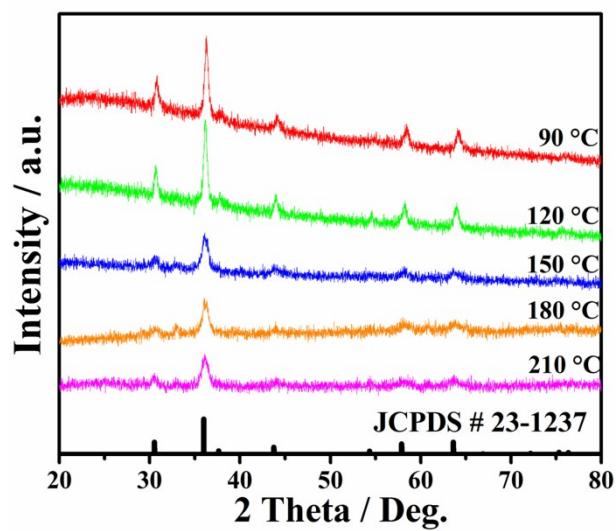


Figure S12. XRD patterns of various morphologies of MnCo₂O₄ via different synthesis temperature.

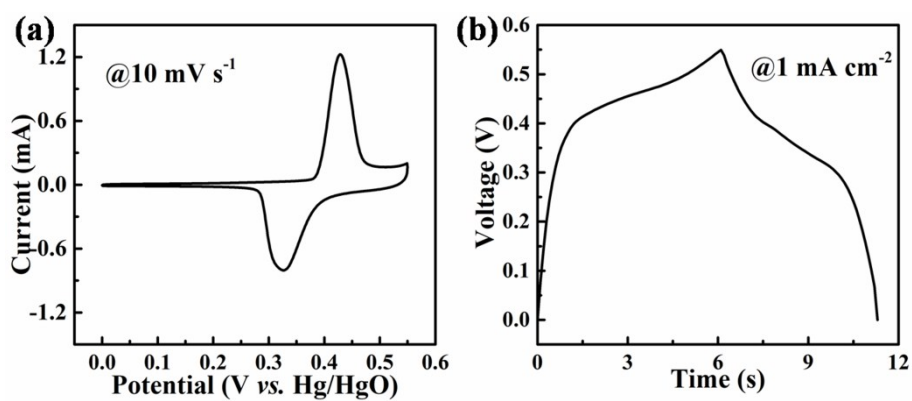


Figure S13. (a) CV curve of the pretreated Ni foam at a scan rate of 10 mV s⁻¹ and (b) GCD curve of the pretreated Ni foam at a current density of 1 mA cm⁻².

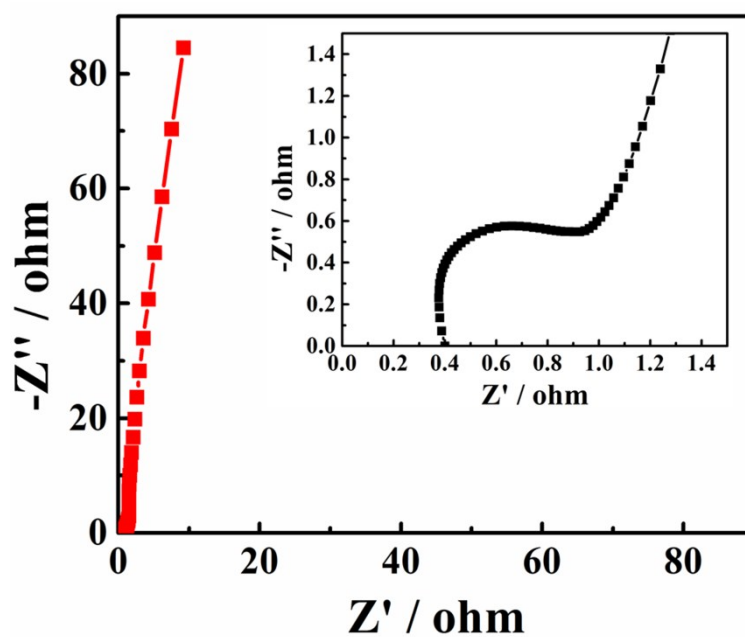


Figure S14. EIS spectrum of as-prepared porous layered stacked MnCo_2O_4 cubes. The insert is a zooming of high frequency region

Table S1. EDS analysis of different morphologies of $\text{MnCo}_2(\text{CO}_3)_3$ at different reaction times.

Reaction times	Morphologies of products	The atomic ratio of Mn and Co
0.5 h		4.2 : 8.7
1 h		5.5 : 7.3
		3.2 : 7.4
2.5 h		7.1 : 8.1
4 h		11.6 : 11.6
		7.9 : 17.2
5.5 h		11.1 : 22.3
7 h		7.0 : 14.2