Electrochemically Tuned Cobalt Hydroxide Carbonate with abundant Grain Boundaries
for Highly Efficient Electro-Oxidation of Hydrazine

Xiaodong Yan,¹,1 Yuan Liu,²,1 Jinle Lan,³ Yunhua Yu,³ James Murowchick,⁴ Xiaoping Yang,³,** Zhonghua Peng,a,*

a Department of Chemistry, University of Missouri – Kansas City, Kansas City, Missouri 64110, United States
b State Key Lab of New Ceramics and Fine Processing, School of Materials Science and Engineering, Tsinghua University, Beijing 100084, China
c State Key Laboratory of Organic-Inorganic Composites, Beijing University of Chemical Technology, Beijing 100029, China
d Department of Geosciences, University of Missouri – Kansas City, Kansas City, Missouri 64110, United States

* Corresponding author. Department of Chemistry, University of Missouri – Kansas City, Kansas City, Missouri 64110, United States
** Corresponding author. State Key Laboratory of Organic-Inorganic Composites, Beijing University of Chemical Technology, Beijing 100029, China

E-mail addresses: PengZ@umkc.edu (Z. Peng); yangxp@mail.buct.edu.cn (X. Yang)

¹ These authors contributed equally.
Fig. S1 Voltammograms of the (A) ECT-Co(OH)$_x$(CO$_3$)$_{0.5(2-x)}$ and (B) pristine Co(OH)$_x$(CO$_3$)$_{0.5(2-x)}$ electrodes collected at varied scan rates of 5, 10, 20, 40, 60, and 80 mV s$^{-1}$ in 1.0 M KOH.
Fig. S2 HTREM image of ECT- Co(OH)$_x$(CO$_3$)$_{0.5(2-x)}$.

Fig. S3 XPS survey spectra of the Co(OH)$_x$(CO$_3$)$_{0.5(2-x)}$ (a) and ECT-Co(OH)$_x$(CO$_3$)$_{0.5(2-x)}$ (b).
Fig. S4 SEM image of the ECT-Co(OH)$_x$(CO$_3$)$_{0.5(2-x)}$ electrode after 350 cycles.

Fig. S5 Voltammograms of the Co$_3$O$_4$ and ECT-Co$_3$O$_4$ electrodes at a scan rate of 20 mV s$^{-1}$ in 0.5 M N$_2$H$_4$ aqueous solution with 1.0 M KOH.
Fig. S6 Voltammograms of the Co(OH)$_2$ and ECT-Co(OH)$_2$ electrodes at a scan rate of 20 mV s$^{-1}$ in 0.5 M N$_2$H$_4$ aqueous solution with 1.0 M KOH.

Fig. S7 Voltammograms of the Ni(OH)$_2$ and ECT-Ni(OH)$_2$ electrodes at a scan rate of 20 mV s$^{-1}$ in 0.5 M N$_2$H$_4$ aqueous solution with 1.0 M KOH.