catalysts

Supplementary Materials: Reduced Graphene Oxide Supported Cobalt-Calcium Phosphate Composite for Electrochemical Water Oxidation

Keunyoung Lee [1], Wonseok Yang [2], Eunji Pyo [1], Hyebin Choi [1], Yeona Cha [1], Seonhong Lee [3], Chung Soo Kim[3], Dong-Kwon Lim [2,*] and Ki-Young Kwon [1,*]

[1] Department of Chemistry, Gyeongsang National University, Jinju, 52828, South Korea; sofiato96@gnu.ac.kr (K.Y.L.); eunji2684@gnu.ac.kr (E.J.P.); gpqls3214@gnu.ac.kr (H.B.C.); 2019010957@gnu.ac.kr (Y.A.C.)
[2] KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul, 02841, South Korea; wowbluesky@korea.ac.kr
[3] Analysis & Certification Center, Korea Institute of Ceramic Engineering & Technology, Jinju, 52851, South Korea; sh0381@kicet.re.kr
* Correspondence: dklim@korea.ac.kr (D.-K.L.); kykwon@gnu.ac.kr (K.-Y.K.); Tel.: +82-2-3290-4611 (D.-K.L.); +82-55-772-1493 (K.-Y.K.)

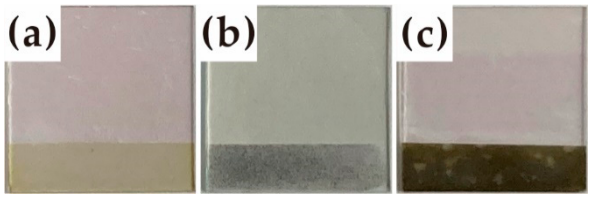


Figure S1. Photographs of ITO electrode (coated area : 2 × 0.5 cm^2). (a) an ITO electrode after the anodic electrolysis for an hour, (b) CaP/rGO ink coated ITO electrode, (c) CoCaP/rGO after the anodic electrolysis for an hour.

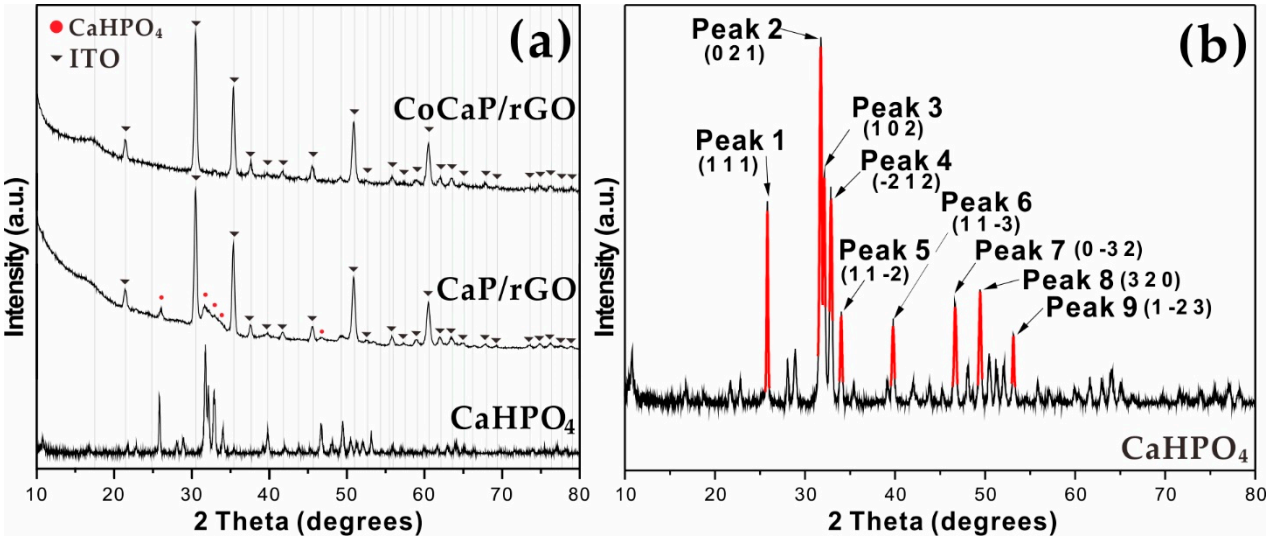


Figure S2. XRD patterns of (a) CaP/rGO, CoCaP/rGO (after anodic electrolysis in Co^{2+} aqueous solution for an hour) on ITO electrodes and $CaHPO_4$ (monetite, red dots), diffraction patterns of an ITO are marked with reversed triangles, (b) Miller facets of nine peaks of $CaHPO_4$.

Table S1. Crystal size of monetite calculated from Scherrer equation (derived from XRD peaks of $CaHPO_4$).

Peak No.	2 Theta (degrees)	Miller index (*h k l*)	FWHM (β)	Crystallite size (nm)
1	25.819	1 1 1	0.186	43.265
2	31.762	0 2 1	0.277	29.445
3	32.134	1 0 2	0.239	34.138
4	32.865	-2 1 2	0.354	23.119
5	34.029	1 1 -2	0.233	35.273
6	39.793	1 1 -3	0.290	28.805
7	46.641	0 -3 2	0.280	30.508
8	49.450	3 2 0	0.281	30.733
9	51.138	1 -2 3	0.176	49.884

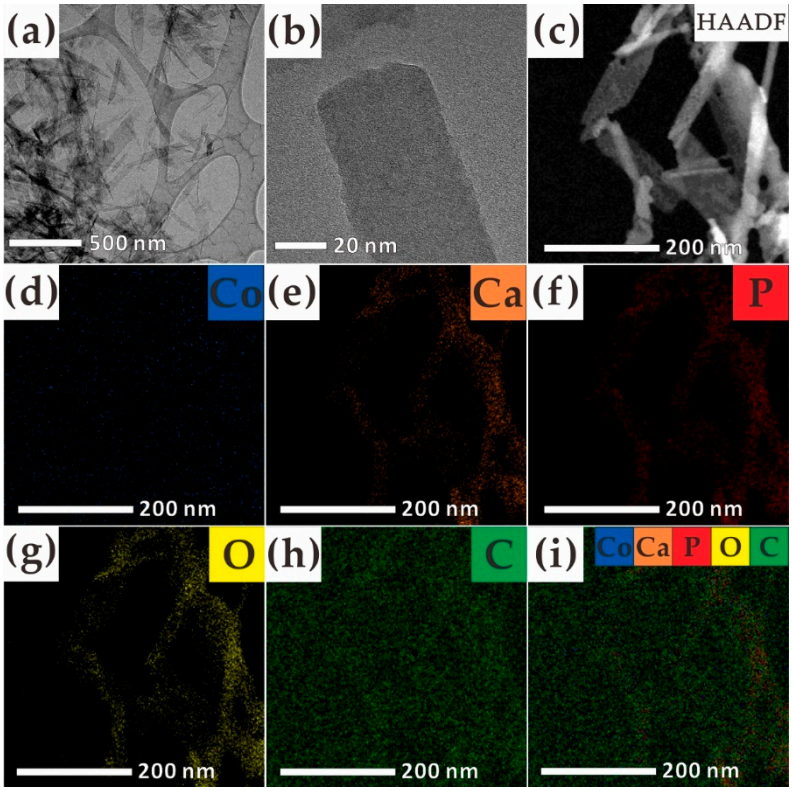


Figure S3. TEM images of (a) CaP/rGO, (b) high resolution TEM image of CaP/rGO and EDS elements mapping of CaP/rGO (c) TEM image, (d) Co, (e) Ca, (f) P, (g) O, (h) C and (i) overlapping of Co, Ca, P, O, C.

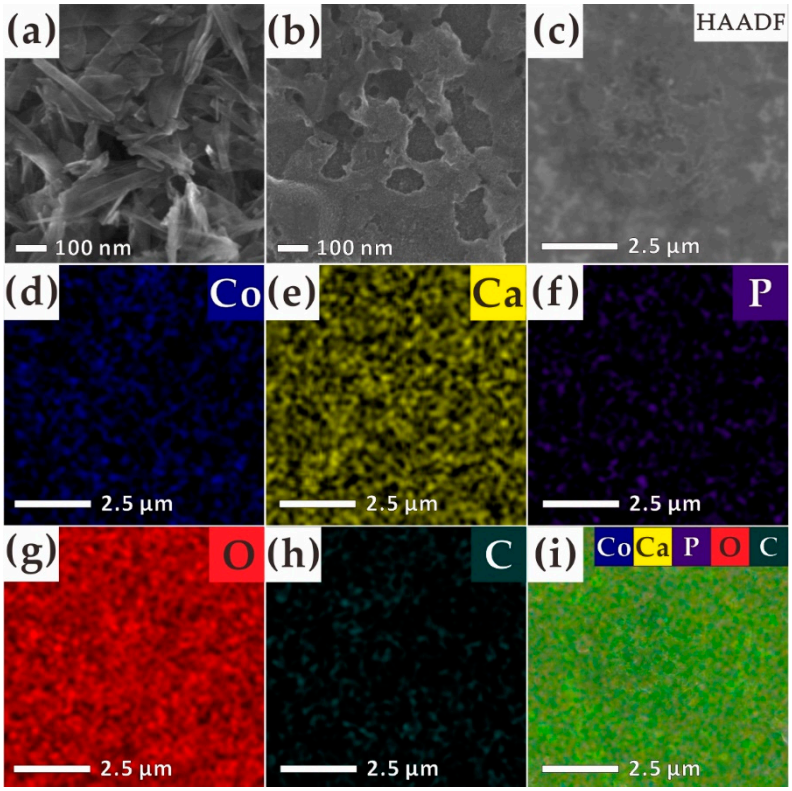


Figure S4. SEM images of (a) CaP/rGO, (b) CoCaP/rGO and EDS elements mapping of Co-CaP/rGO (c) SEM image, (d) Co, (e) Ca, (f) P, (g) O, (h) C and (i) overlapping of Co, Ca, P, O, C.

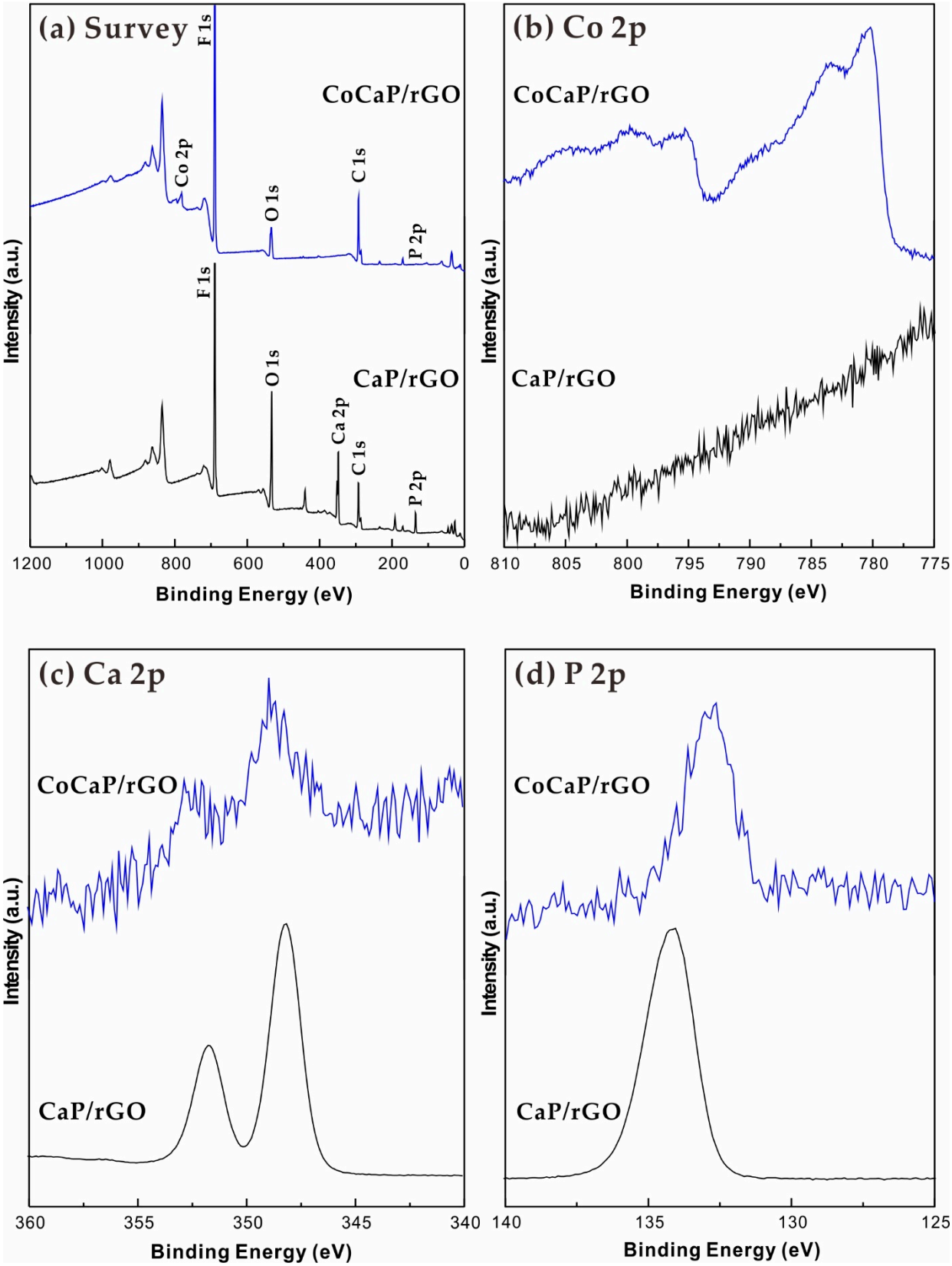
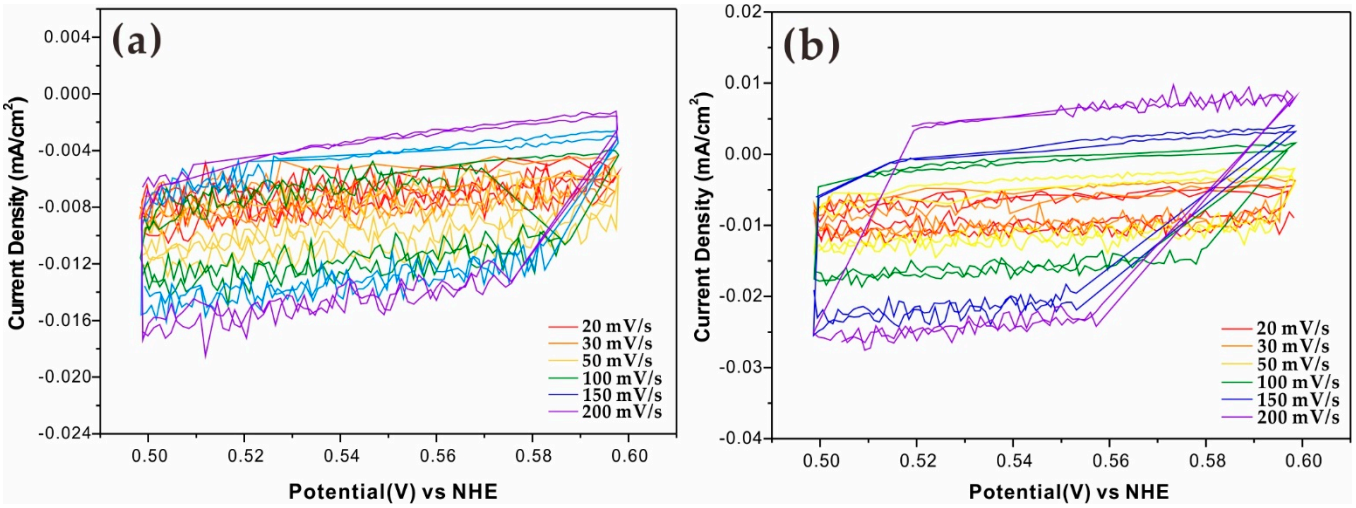


Figure S5. XPS spectrum of (a) Survey spectrum of CaP/rGO and CoCaP/rGO, (b) for Co 2p, (c) Ca 2p and (d) P 2p.

Figure S6. Cyclic Voltammetry (CV) measurements in the potenial range of 0.5~0.6 V vs NHE with different sweep rates (20~200 mV/s). (a) CoCaP and (b) CoCaP/rGO



Movie S1. Anodic electrolysis of CaP/rGO at 1.3 V vs NHE for an hour in 20 mM Co^{2+}.

Movie S2. Bulk electrolysis for an initial time, after 6 hr, 24 hr and 48 hr of the CoCaP/rGO on ITO electrode.