

Supplementary information

Simple microplasma reactor paired with indirect ultrasonication for aqueous phase synthesis of cobalt oxide nanoparticles

Sosiawati Teke^a, Md. Mokter Hossain^b, Roshan Mangal Bhattarai^a, Shirjana Saud^a, Avik Denra^a, Mai Cao Hoang Phuong Lan Nguyen^a, Adnan Ali^a, Van Toan Nguyen^c, Young Sun Mok^{a,}*

^a Department of Chemical Engineering, Jeju National University, Jeju-63243, Republic of Korea.

^b Department of Chemical and Biological Engineering, University of Idaho, Moscow-83844, United States.

^c Faculty of Mechanical Engineering, Le Quy Don Technical University, Vietnam.

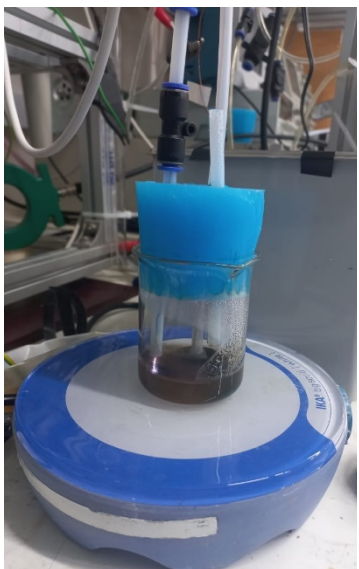
Corresponding author: smokie@jejunu.ac.kr

Tel.: +82-64-754-3682; Fax: +82-64-755-3670

Characterization of materials

Absorption spectra were recorded using a Scinco (Mega-2100) double-beam UV-Vis spectrophotometer in the spectral range of 325-700 nm. The microstructures and morphologies of the samples were observed by scanning electron microscopy (FE-SEM) (TESCAN, MIRA3) and transmission electron microscopy (TEM) (Talos F200X G2). The chemical compositions were evaluated by energy-dispersive spectroscopy (TEM-EDS) measurements. The phase composition of the material was identified by X-ray diffraction (XRD) analysis performed using a PAN analytical Empyrean X-ray diffractometer with a Cu K α ($\lambda = 0.15405$ nm) radiation source and operating at 40 kV, 30 mA, with a scan range (2θ) of 5° to 90° . A surface analysis study using X-ray photoelectron spectroscopy (XPS) was conducted using a Theta Probe anglesolved XPS system (Thermo Fisher Scientific Inc., U.K.) with monochromatic Al K α in the range of 1486.6–154 eV at 15 kV.

A)



B)

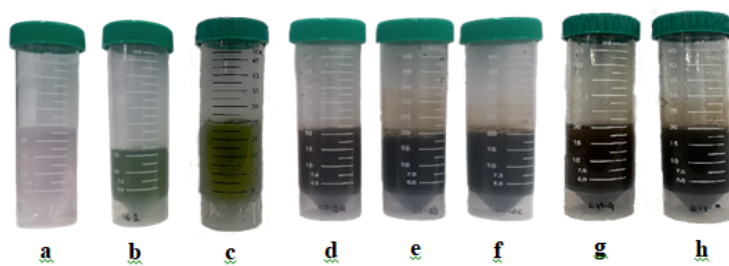


Figure S1: A) Precursor treated by microdischarge plasma for 25min. B) Color of precursor before and after reaction, Cobalt 0.01 M before microplasma treatment: (a) pH 7, (b) pH 10, and (c) pH 12 and Cobalt 0.01 M and pH 10 reaction time 25 min.: (d) MPR, (e) MPR-MS, (f) MPR-Son, (g) MPR-urea, and (h) MPR-Suc.

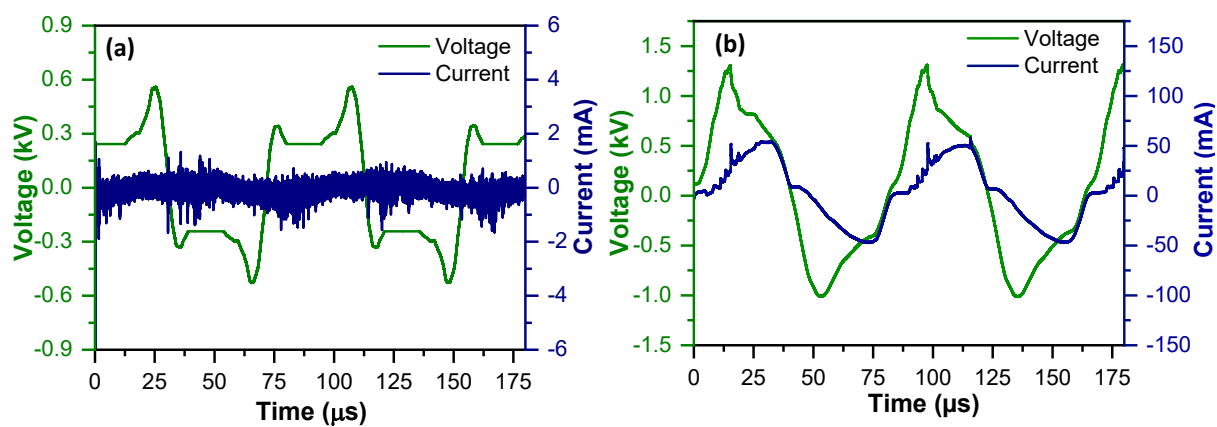


Figure S2: Current-voltage waveform: Inlet gas used air :(a) without microplasma formed and (b) with microplasma formed.

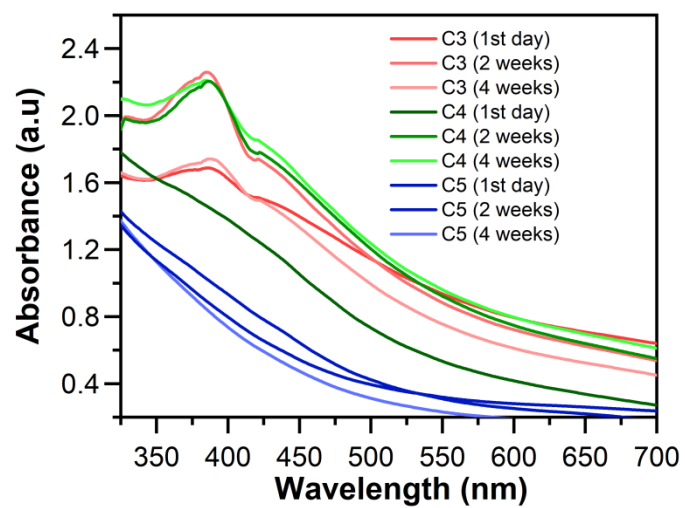


Figure S3: UV-Vis spectrum of cobalt oxide with treatment time 25 min from 1st day to 4 weeks

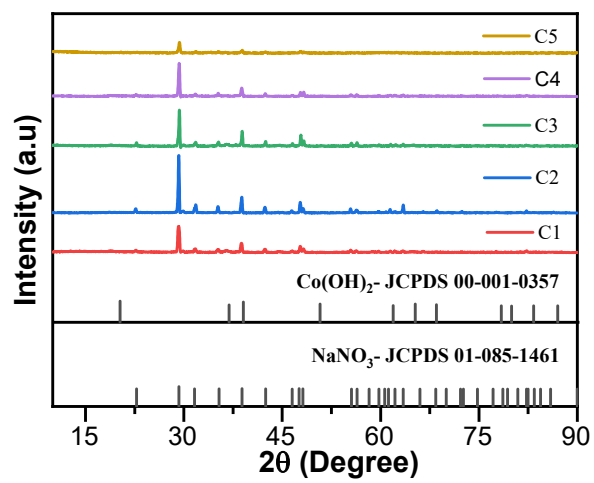


Figure S4. XRD pattern cobalt oxide without calcination