Supporting Information

A High-performance Oxygen Evolution Anode from Stainless Steel via Controlled Surface Oxidation and Cr Removal

Sengeni Anantharaj[†‡], Murugadoss Venkatesh[‖], Ashish S. Salunke[‖], Tangella V. S. V. Simha[‖], VijayakumarPrabu[#] and Subrata Kundu[†‡ƨ]*

[†]Academy of Scientific and Innovative Research (AcSIR), CSIR-Central Electrochemical Research Institute (CSIR-CECRI) Campus, New Delhi, India

[‡]Electrochemical Materials Science (ECMS) Division, CSIR-Central Electrochemical Research Institute (CECRI), Karaikudi-630006, Tamil Nadu, India

[‖]Centre for Education (CFE), CSIR-Central Electrochemical Research Institute (CECRI), Karaikudi-630006, Tamil Nadu, India

[#]Central Instrumentation Facility (CIF), CSIR-Central Electrochemical Research Institute (CECRI), Karaikudi-630006, Tamil Nadu, India

[ƨ]Department of Materials Science and Engineering, Texas A&M University, College Station, Texas, TX-77843, USA

* To whom correspondence should be addressed, Electrochemical Materials Science (ECMS) Division, CSIR-Central Electrochemical Research Institute (CECRI), College Road, Karaikudi-630006, Tamil Nadu, India *E-mail:* kundu.subrata@gmail.com; skundu@cecri.res.in, *Phone*: (+ 91) 4565-241486 and (+ 91) 4565-241487.

This file contains 3 pages in which the details on reagents and instruments used in the study, electrode fabrication method for IrO_2/SSand FESEM micrographs of bare SS, SS-KOH-24 and SS-06 are provided periodically.

Reagents and Instruments

Potassium hydroxide and sodium hypochlorite solution of 11-14% Cl_2 equivalent were procured from Alfa Aeasar. The Stainless Steel foil, 0.025mm (0.001in) thick was also purchased from Alfa Aesar. Commercial IrO_2 catalyst and 5 % Nafion suspension in alcohol water mixture were obtained from Sigma Aldrich. Hg/HgO reference electrode, Pt-foil counter electrodes were purchased from CH InstrumentsPvt. Ltd. Deionized water (18.2 $M\Omega cm^{-2}$) was used for the entire study wherever required. The controllably corroded SS foils were characterized with HR-TEM, (Tecnai^{TM} G^2 TF20) working at an accelerating voltage of 200 kV.TheEnergy Dispersive X-ray Spectroscopy (EDS) analysis was done with the FE-SEM instrument (Oxford) with a separate EDS detector connected to that instrument. The XRD analysis was done with a scanning rate of 5° min^{-1} in the 2θ range 10-90° using a Bruker X-ray powder diffractometer (XRD) with Cu K_α radiation (λ = 0.154 nm). X-ray photoelectron spectroscopic (XPS) analysis was performed using a Theta Probe AR-XPSsystem (Thermo Fisher Scientific, UK). Electrochemical analyzer CHI6084c version 12.13 was used for the entire electrochemical characterization.

Fabrication of IrO_2/SS Electrode for Comparative Studies

About 3 mg of IrO_2 powder procured from Sigma Aldrich was dispersed in 1 mL solution of water, isopropyl alcohol and Nafion ionomer suspension prepared with the volume ratio of 0.75 mL:0.20 mL: 0.05 mL respectively. The above mixture was then homogenized by continuous sonic treatment which lasted for 20 min. The about 0.205 mL (corresponding loading is 0.6 $mgcm^{-2}$) of the prepared ink was carefully casted in one side of bare SS substrate electrode of geometrical area of 1 cm^{-2}. Other uncoated portions of the SS substrates were masked using commercially available sticky tap. Then the IrO_2 ink casted SS substrate electrode was dried at ambient conditions for overnight before its use in comparative electrocatalytic water oxidation study.Surface oxidized SS foils were wrapped with insulating PTFE masking tape leaving 0.5 x 0.5 cm on both sides which would correspond to a surface area of 0.5 cm^2 together and the same was used to moralize the observed current. The electrical contact was given placing a piece of highly conductive Al foil of appropriate size between the surface modified SS foil and the crocodile clip provided to connect the working electrode to the electrochemical workstation.

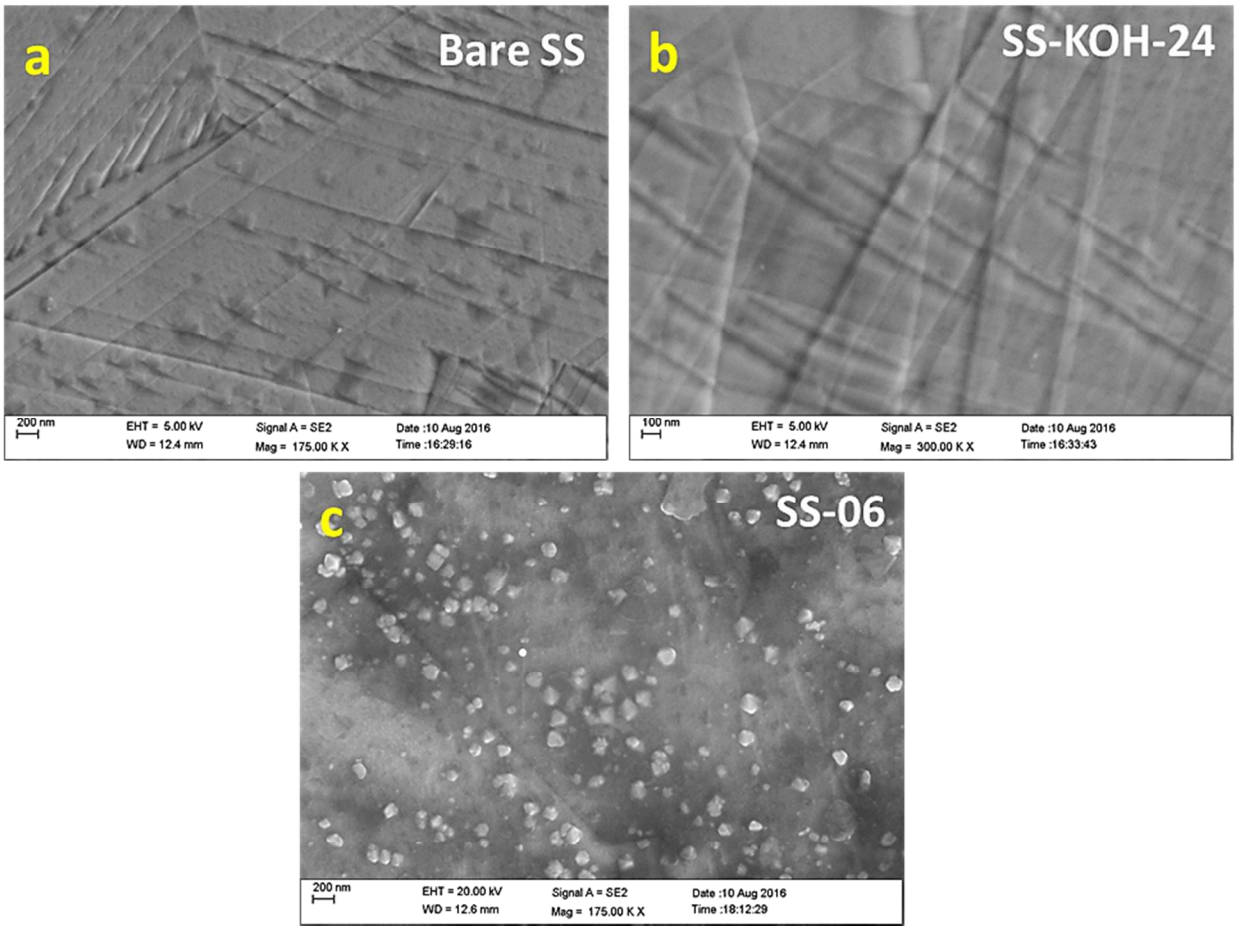

Figure S1: (a-c) The FESEM micrographs showing the surface texture of bare SS, SS-KOH-24 and SS-06 respectively.