**Role of rhodium doping into lanthanum cobalt oxide (LaCoO3) perovskite and the induced bifunctional activity of oxygen evolution and reduction reactions in alkaline medium**

Mohamed A. Ghanem,a\* Mabrook S. Amer,a Prabhakarn Arunachalam,a,\* Abdullah M. Al-Mayouf,a Mark T. Wellerb

*a Chemistry Department, King Saud University, Riyadh11451, Saudi Arabia.*

*b Chemistry Department, Cardiff University, Cardiff, CF10 3AT, UK.*

*\* Corresponding author Email:* [*mghanem@ksu.edu.sa*](mailto:mghanem@ksu.edu.sa)

*Tel: +966 114670405; Fax: +96614675992*

**Supporting Information:**

*-XPS analysis of LaCo0.7Rh0.3O3 catalyst.* The X-ray photoelectron spectroscopy (XPS) of the catalysts was executed as reported in the experimental part and using the carbon peak (C 1s) located at 284.8 eV for charge correction. The deconvoluted XPS core spectra of rhodium shown in Figure S1a shows the presence of the doublet characteristic peaks for rhodium oxide located at binding energies of 306.26 and 310.24 eV, that can assign to the Rh 3d5/2 and Rh 3d3/2 levels. Figure S1b shows the deconvoluted core XPS spectra of Co 2p zone which compromised multi-peaks that related to the Co 2p3/2 and Co 2p1/2 levels which extended over the 740 to 800 eV binding energy values. The XPS spectra of Co 2p is complex due to the presence of satellite peaks and different cobalt oxidation states due to coordinated to a different number of oxygen atoms. However, the main peaks located at 745.60 and 775.85 eV can be assign to the Co 2p3/2 and Co 2p1/2 levels respectively. Moreover, the Co 2p3/2 and Co 2p1/2 peaks itself can be further deconvoluted to four peaks at 742.61, 750.46, 773.85, 781.54 eV that corresponding to Co2+ and Co3+ oxidation states respectively.



**Figure S1** XPS spectra of LaCo0.7Rh0.3O3 catalyst **(**a)the core-level of Rh 3d spectra and (b) the core-level of Co 2p spectra.



**Figure S2** (a) LSV at 50 mV/s for the LaCo0.7Rh0.3O3/CP electrodes in 1.0 M KOH with the difference of catalyst loading, (b) plot for the correlation between catalyst loading against the potential at 10 mA/cm2 (black line) and the OER current density attained at 1.80 Vvs HRE (red line), (c) the LSV plots at 50 mV/s of the LaCo0.7Rh0.3O3/CP (loading of 0.3 mg/cm2) in different concentrations of KOH.