2-Nitrophenol sensor based wet-chemically prepared binary doped Co_3O_4/Al_2O_3 nanosheets by electrochemical approach

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Supporting information

Optimization of 2-Nitrophenol chemical sensor (Intra-day):

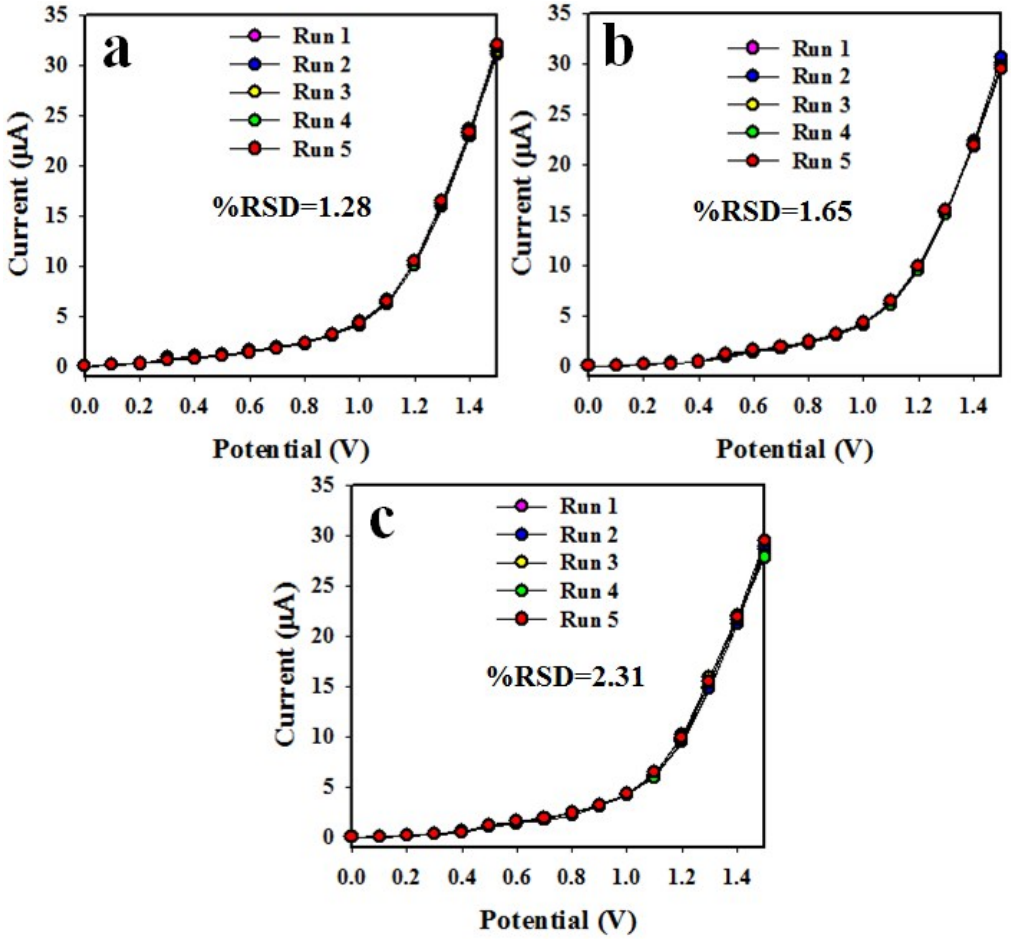

Fig. S1 Optimization of 2-Nitrophenol chemical sensor based on Co_3O_4/Al_2O_3 NSs, (a) repeatability at o hour, (b) repeatability after 2 hour, and (c) repeatability after 4 hours,

Optimization of 2-Nitrophenol chemical sensor (Inter-day):

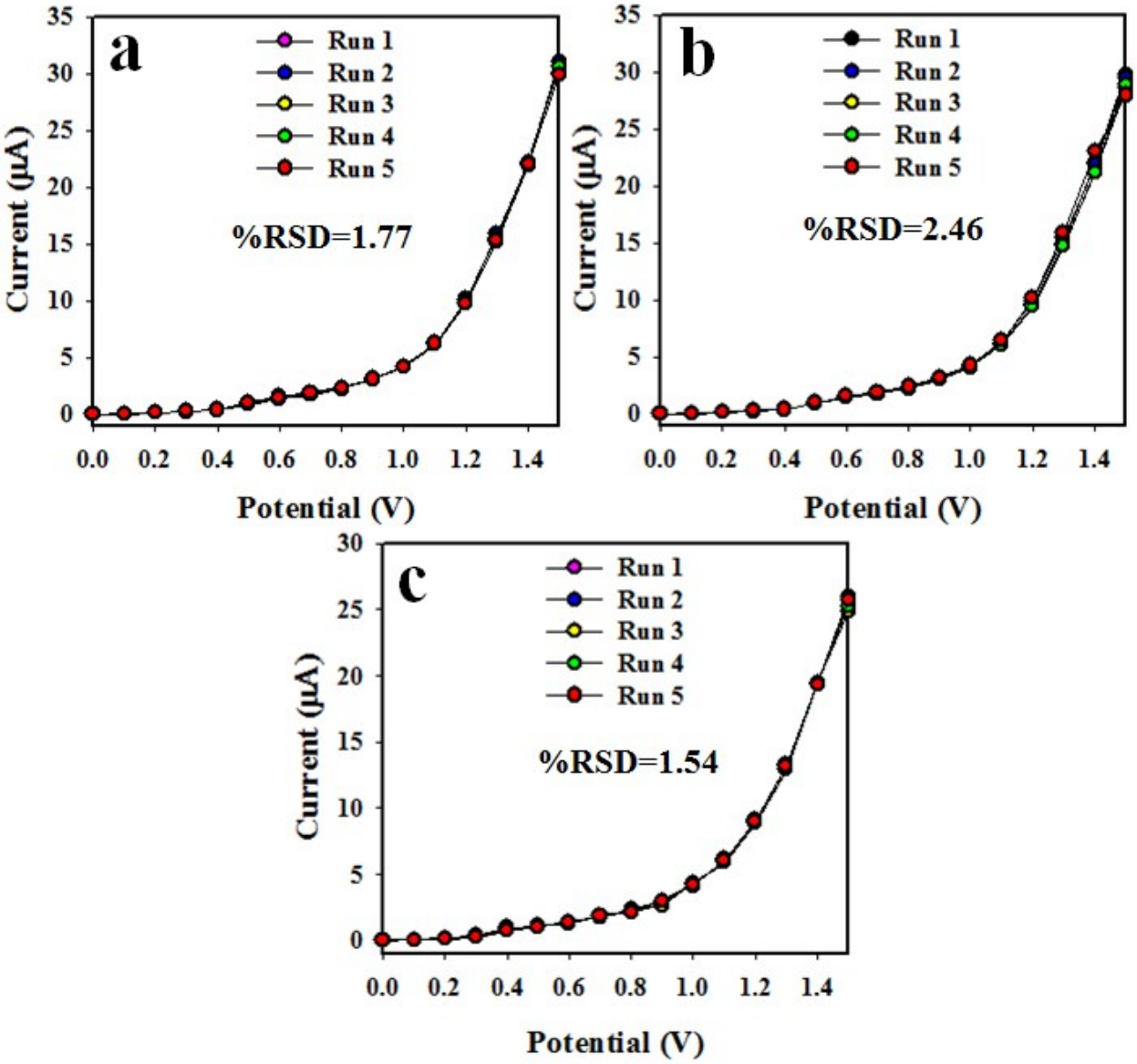

Fig. S2 Optimization of 2-Nitrophenol chemical sensor based on Co_3O_4/Al_2O_3 NSs , (a) repeatability at beginning day, (b) repeatability at 2nd day, and (c) repeatability after 3rd day,

Electrochemical responses in mixtures:

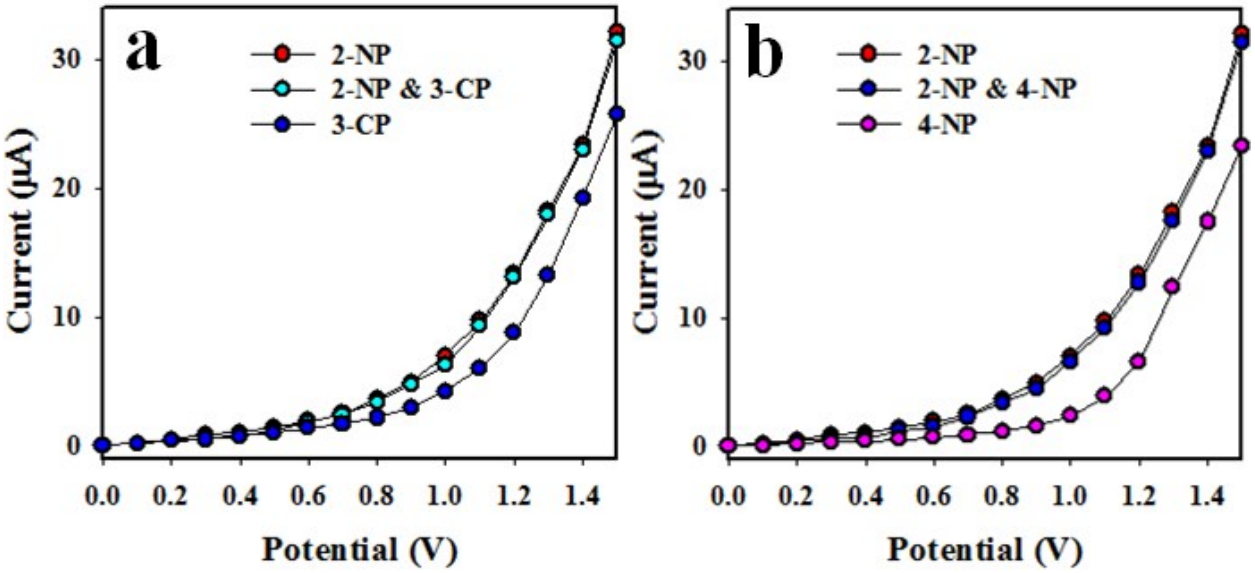

Fig. S3 The reliable control measurements of 2-NP based on Co_3O_4/Al_2O_3 NSs/GCE, (a) I-V responses in mixed or single target chemicals such as 2-NP, 2-NP+3-CP and 3-CP, (b) I-V responses in mixed or single target chemicals such as 2-NP, 2-NP+4-NP and 4-NP.

Optical evaluations:

The photosensitivity of prepared NSs of Co_3O_4/Al_2O_3 were investigated by UV-vis analysis, which is illustrated in **Fig. S4**a. The UV-vis spectrum is a characteristic of the absorption of radiant energy of visible light and the transition of the outer electrons of the atoms from lower to higher energy level.[1] In this work, the UV absorption study is performed in the range of 290 to 800 nm at room temperature. The resulted spectrum contains a wider and intense peak at 307 nm (an enlarged view is shown in the inset of **Fig. S4a** and this is the characteristic band of synthesized Co_3O_4/Al_2O_3 NSs. The obtained UV absorption band is authenticated for the transition of valance electron of prepared NSs from lower to higher energy level.[2-4] According to the equation (6); the calculated band gape energy is 4.04 eV.

$$E_{bg} = 1240/\lambda_{max} \qquad (6)$$

Here, E_{bg} = band-gap energy, λ_{max} = maximum absorbed wave length.[5,6]

To identify the functional groups existing in the prepared NSs, the Co_3O_4/Al_2O_3 NSs were investigated by Fourier-transform infrared (FTIR) spectroscopy, which is presented in **Fig. S4**b. The FTIR is performed at range of 450–4000 cm^{-1} and resultant peaks are obtained from the corresponding atomic or molecular vibration. As it is seen in FTIR spectrum, the several major peaks at 536, 658, 1634 and 3414 cm^{-1} are observed. The two major peaks at 536 and 658 cm^{-1} are associated to the stretching vibrations of Co–O. This observation is consistent with those reported by previous authors.[7-9] The peaks at 1634 and 3400 cm^{-1} are assigned to O-H stretching vibration mode[10-13] due to the adsorption of water from environment.

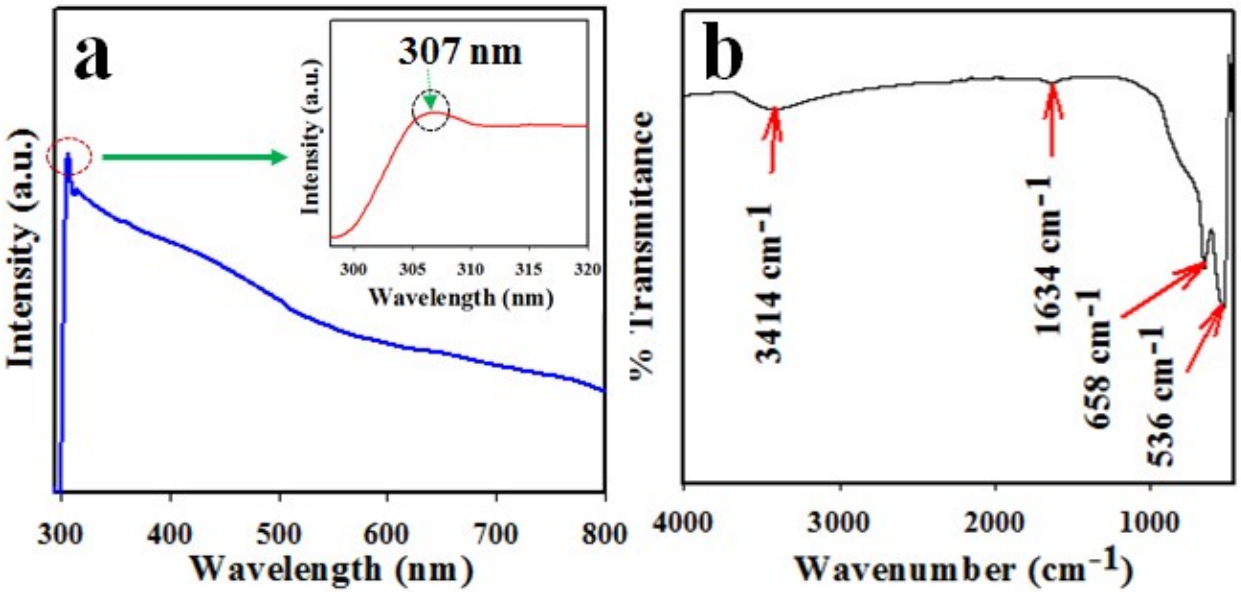

Fig. S4. Optical characterization of doped Co_3O_4/Al_2O_3 nanomaterials. (a) UV/vis. Spectroscopy and (b) FTIR spectroscopy

XPS analysis of doped Co_3O_4/Al_2O_3 nanomaterials:

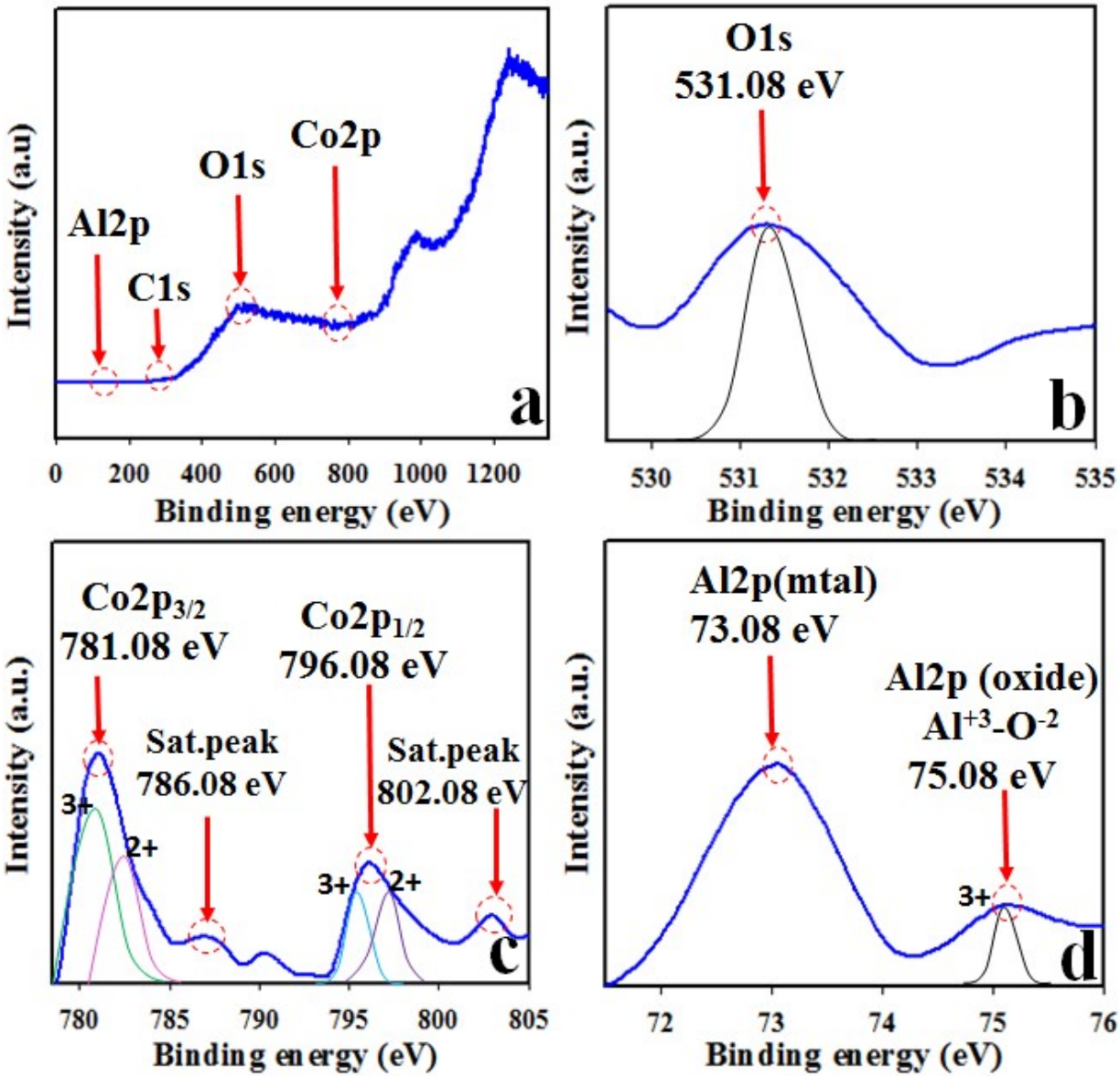

Fig. S5. XPS analysis of doped Co_3O_4/Al_2O_3 nanomaterials

References:

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