Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

ECSA calculations

The ECSA (cm^2) was calculated from Fig. 2 by employing the monolayer adsorption charge of hydrogen onto Pt, 210 $\mu C/cm^2$ with the aid of this equation [32, 34, 42]:

$$ECSA = \frac{Q\ of\ H_{des}(\mu C) from\ Fig.2}{210\ \mu C/cm^2}$$

The charge of Hdes was estimated directly from the potentiostat for the Hdes peak on Pt as indicated in the following figure:

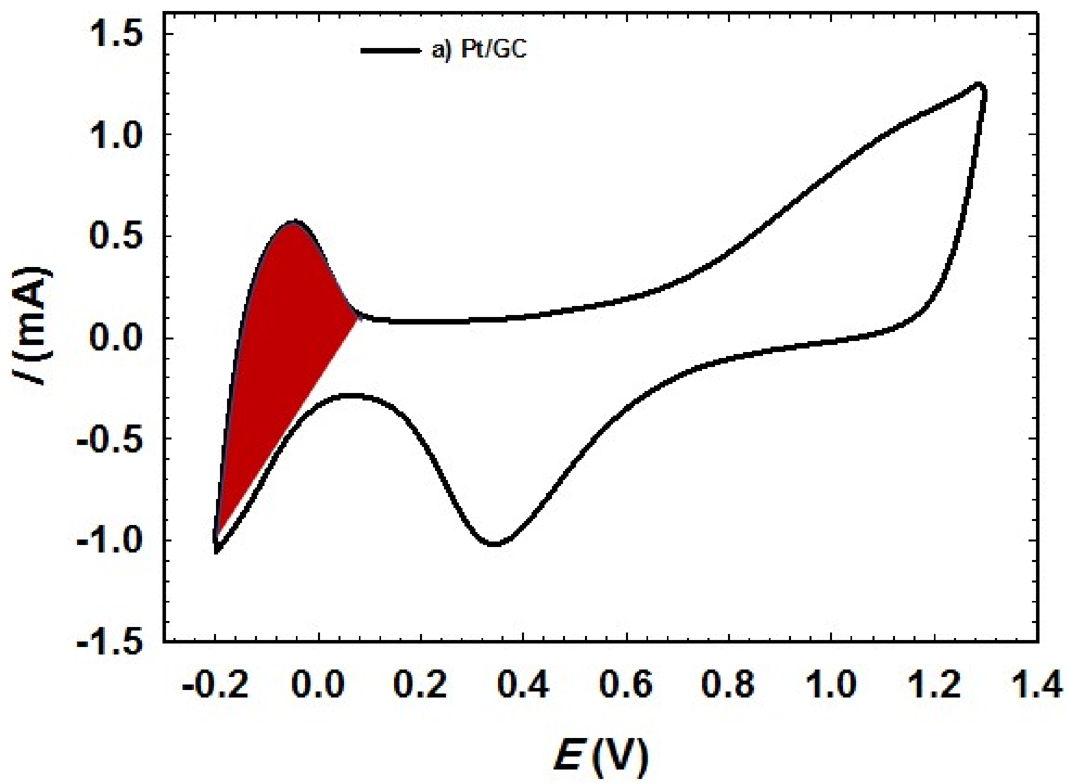


Fig. S1: CVs obtained for the Pt/GC in 0.5 mol L^{-1} H_2SO_4 at a scan rate of 200 mV/s. The highlighted area is used to assess the charge (Q) involved in the H_{des} peak.

$$ECSA\ of\ the\ Pt/GC\ catalyst = \frac{42\ \mu C}{210\ \mu C\ cm^{-2}} = 0.2\ cm^2$$

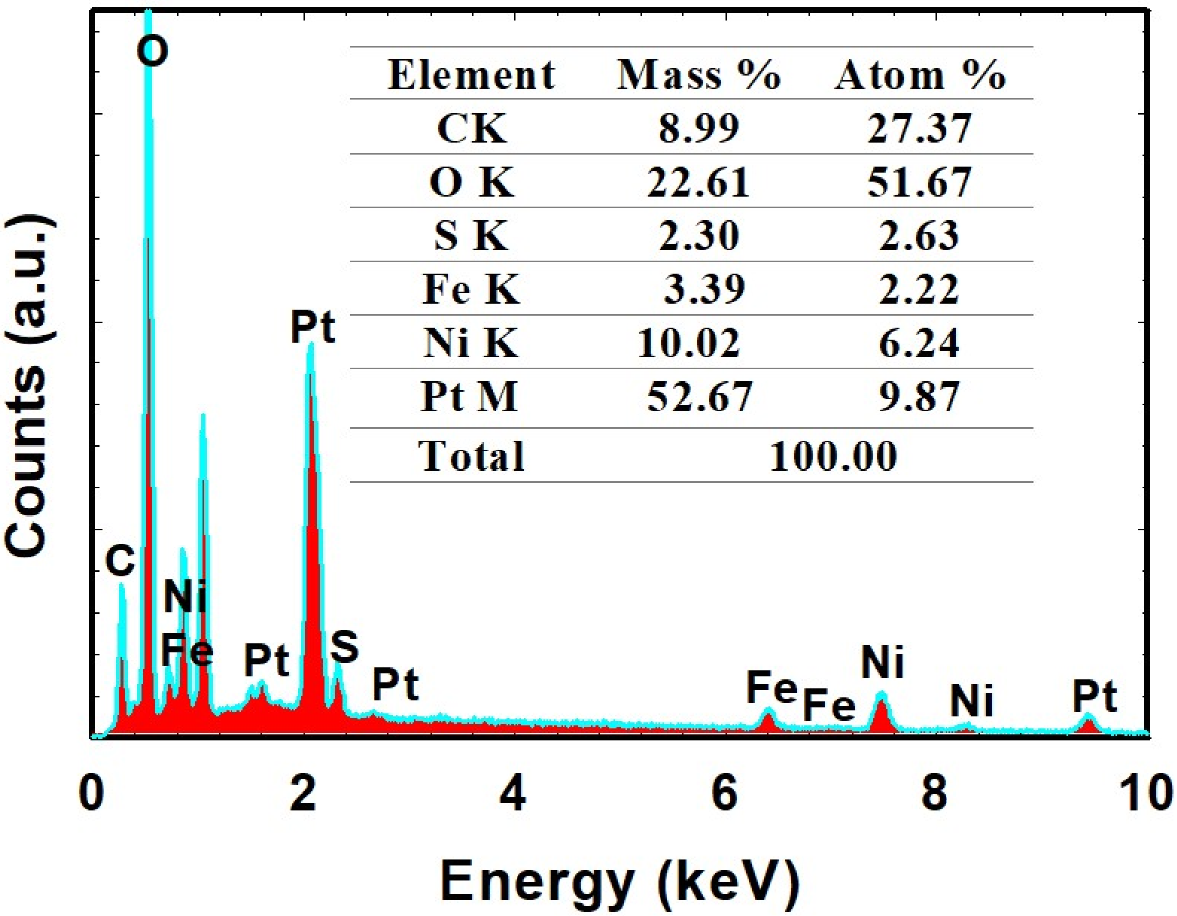
$$ECSA\ of\ the\ NiOx/Pt/GC\ catalyst = \frac{26.46\ \mu C}{210\ \mu C\ cm^{-2}} = 0.126\ cm^2$$

$$ECSA\ of\ the\ FeOx/NiOx/Pt/GC\ catalyst = \frac{23.1\ \mu C}{210\ \mu C\ cm^{-2}} = 0.11\ cm^2$$

$$ECSA\ of\ the\ a - FeOx/NiOx/Pt/GC\ catalyst = \frac{14.7\ \mu C}{210\ \mu C\ cm^{-2}} = 0.07\ cm^2$$

$$ECSA\ of\ the\ NiOx/FeOx/Pt/GC\ catalyst\ = \frac{23.1\ \mu C}{210\ \mu C\ cm^{-2}} = 0.11\ cm^2$$

$$ECSA \frac{at\ NiOx/a - FeOx/Pt}{GC} catalyst = \frac{18.9\ \mu C}{210\ \mu C\ cm^{-2}} = 0.09\ cm^2$$



Element	Mass %	Atom %
CK	8.99	27.37
O K	22.61	51.67
S K	2.30	2.63
Fe K	3.39	2.22
Ni K	10.02	6.24
Pt M	52.67	9.87
Total	100.00	

Fig. S2: The EDX spectrum of FeOx/NiOx/Pt/GC electrode.

Mass of Nano-Pt calculation.

We care in estimating the mass activity only about the mass of the precious element (Pt) that can be calculated from Faraday's law using the charge employed in the nano-Pt deposition. As mentioned in the experimental section, nano-Pt was deposited onto the GC electrode via potential step electrolysis (from 1 to 0.1 V) for 300 s in 0.1 mol L^{-1} H_2SO_4 containing 1 mmol L^{-1} K_2PtCl_6 solution. To calculate the mass activity in mA mg^{-1}_{Pt}, the current obtained for FAO was divided by the mass of deposited Pt (mg_{Pt}). This mass of nano-Pt was 5.0 µg, as estimated from the integrated charge, Q, in the i-t curve (Fig. S3) of the nano-Pt deposition using Faraday's law:

$$m = \frac{QM}{zF}$$

where M is atomic mass of Pt, z (= 4) is the number of transferred electrons in the nano-Pt deposition, F (≈ 96,500 C $mole^{-1}$) is the Faraday's constant.

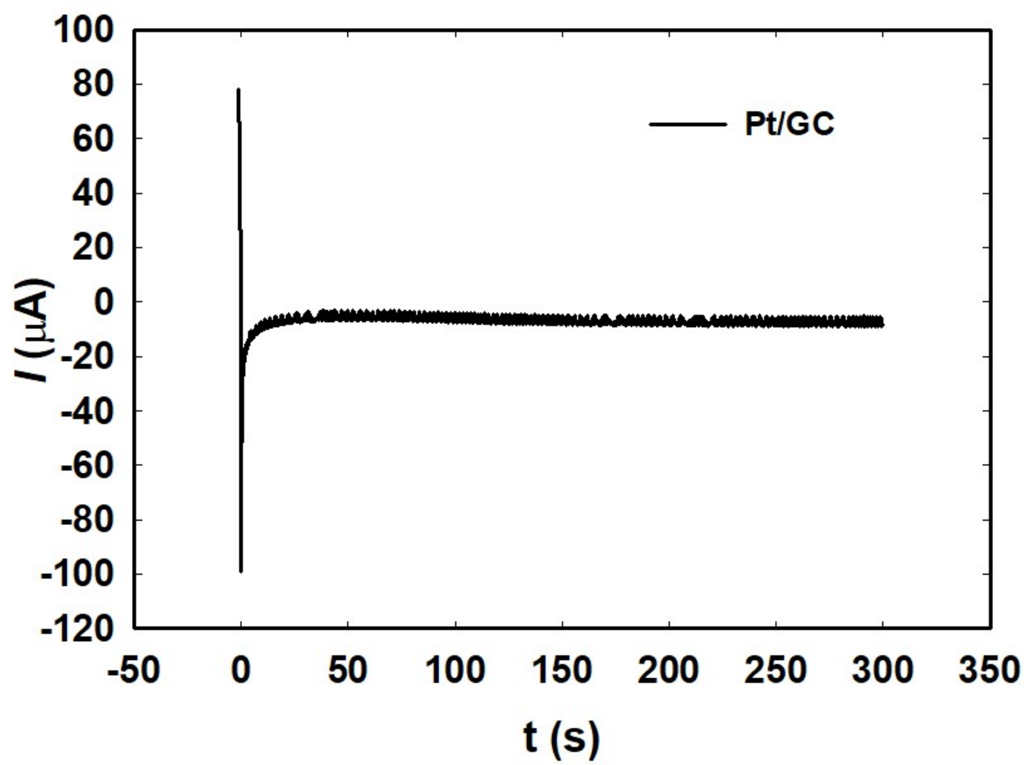


Fig. S3: The i-t curve of the nano-Pt deposition onto the GC electrode.