Electronic Supplementary Information

# Changes induced by transition metal oxides in Pt nanoparticles unveil the effects of electronic properties on oxygen reduction activity

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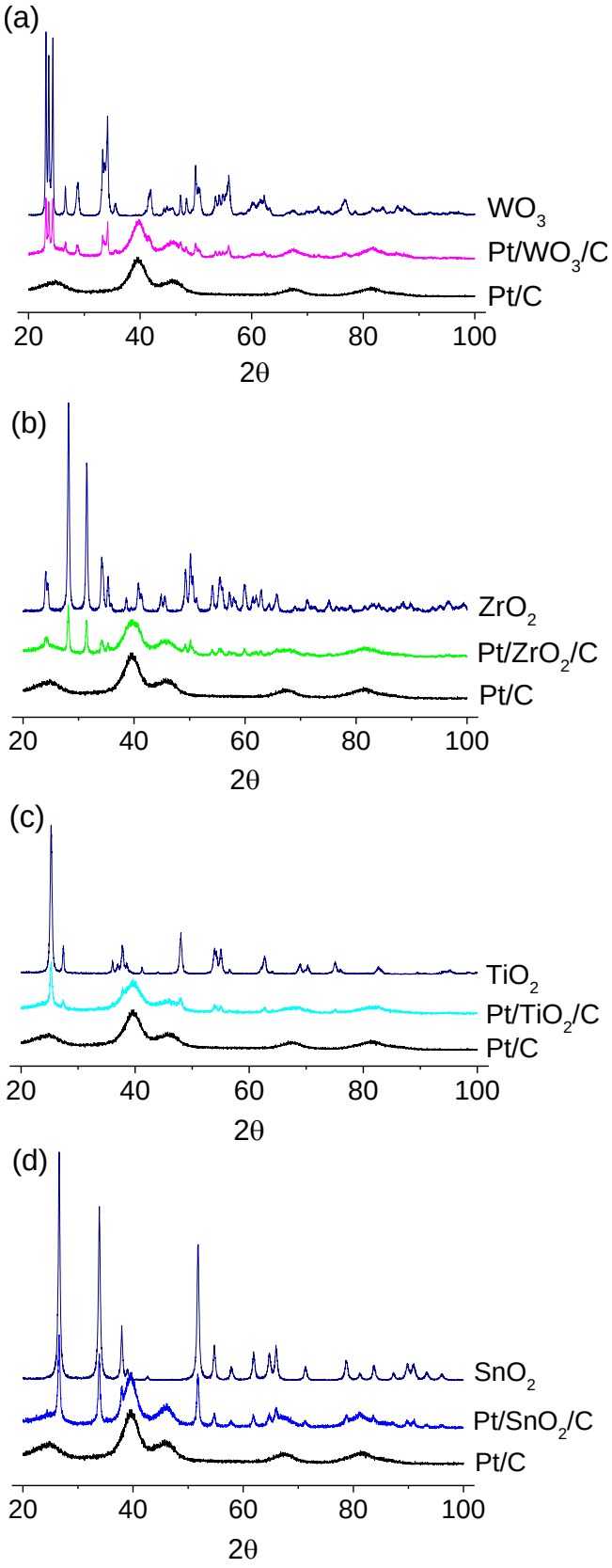


**Fig. S1** Comparison of X-ray diffraction patterns of $Pt/WO_3/C$ (a), $Pt/ZrO_2/C$ (b), $Pt/TiO_2/C$ (c) and $Pt/SnO_2/C$ with those of Pt/C and the corresponding transition metal oxide.

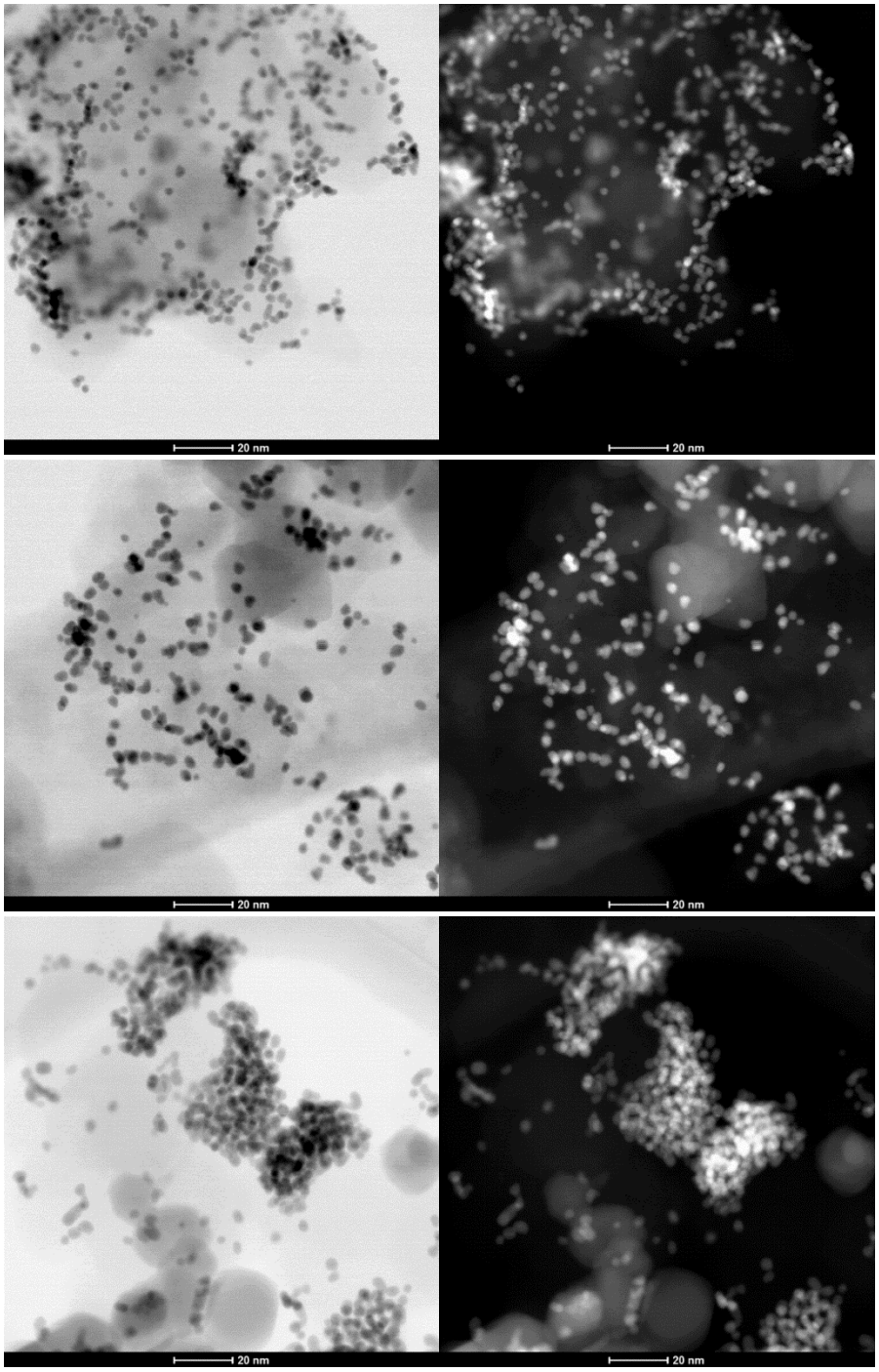


**Fig. S2** HR-STEM images obtained in bright and dark field. From top to bottom: Pt/C, Pt/$TiO_2$/C and Pt/$SnO_2$/C.

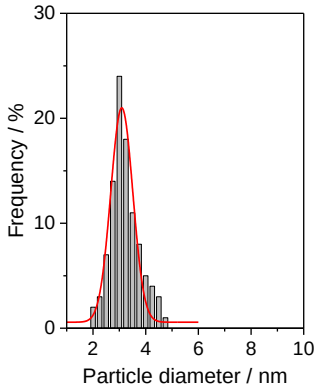


**Fig. S3** Histogram of particle size distribution for Pt/C catalyst.

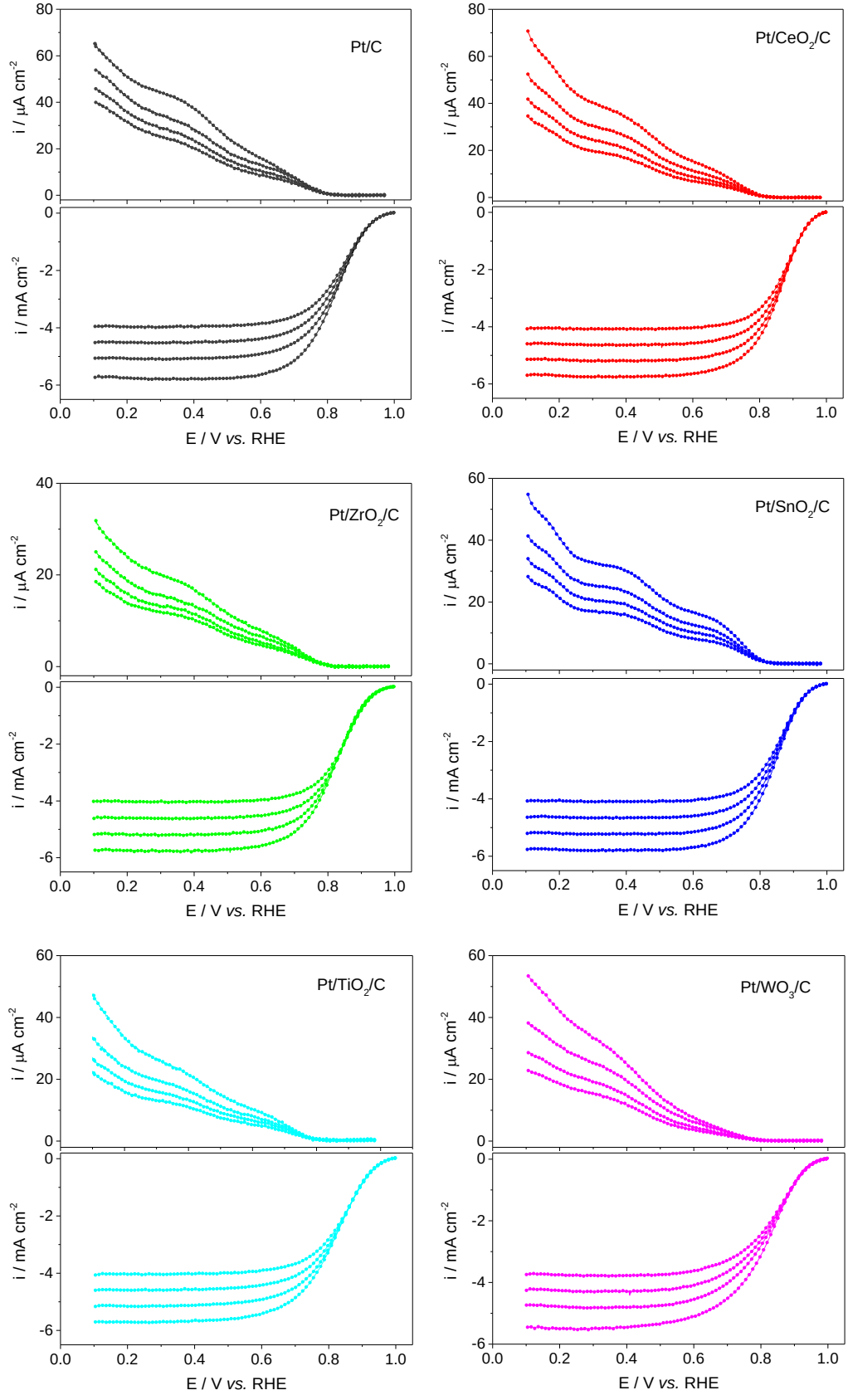


**Fig. S4** Current densities of oxygen reduction and $H_2O_2$ oxidation measured in 0.5 M $H_2SO_4$ solution at rotation rates of 1225, 1600, 2025 and 2500 rpm. Currents are presented normalized by the geometric areas of the electrodes (0.247 $cm^2$ for disk and 0.187 $cm^2$ for ring). RRDE collection efficiency: 0.37.

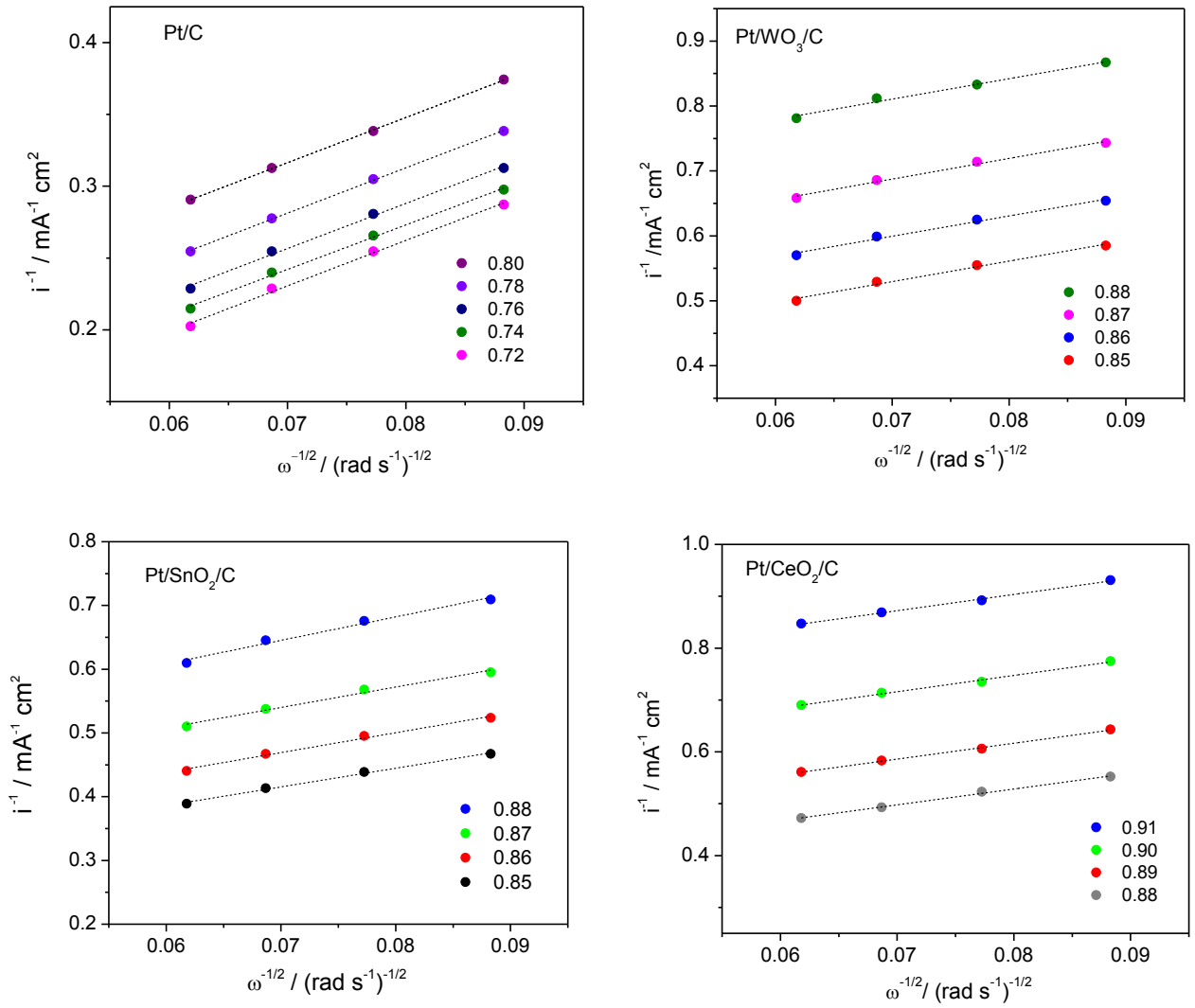


**Fig. S5** Koutecky-Levich plots for Pt/C, $Pt/WO_3/C$, $Pt/SnO_2/C$ and $Pt/CeO_2/C$ catalysts constructed from disk currents at different potentials. Electrolyte: 0.5 M $H_2SO_4$. The number of electrons was estimated using Co= 1.1 $10^{-6}$ g mol $cm^{-3}$, D= 1.4 $10^{-5}$ $cm^2$ $s^{-1}$ and ν= 1.2 $10^{-2}$ $cm^2$ $s^{-1}$.

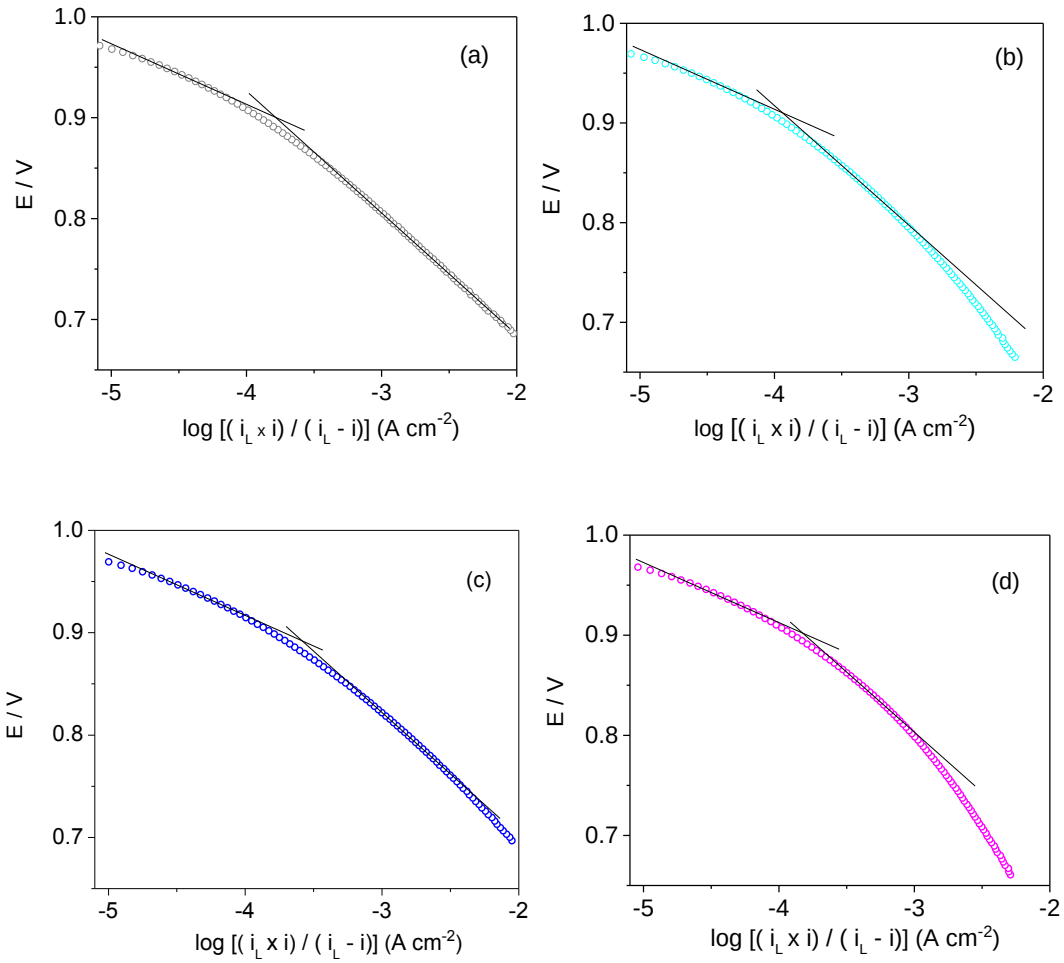


**Fig. S6** Tafel plots for Pt/C (a), $Pt/TiO_2/C$ (b), $Pt/SnO_2/C$ (c) and $Pt/WO_3/C$ (d). The lines correspond to –60 mV $dec^{-1}$ and –120 mV $dec^{-1}$. Kinetic current densities obtained by normalization by Pt EAA.

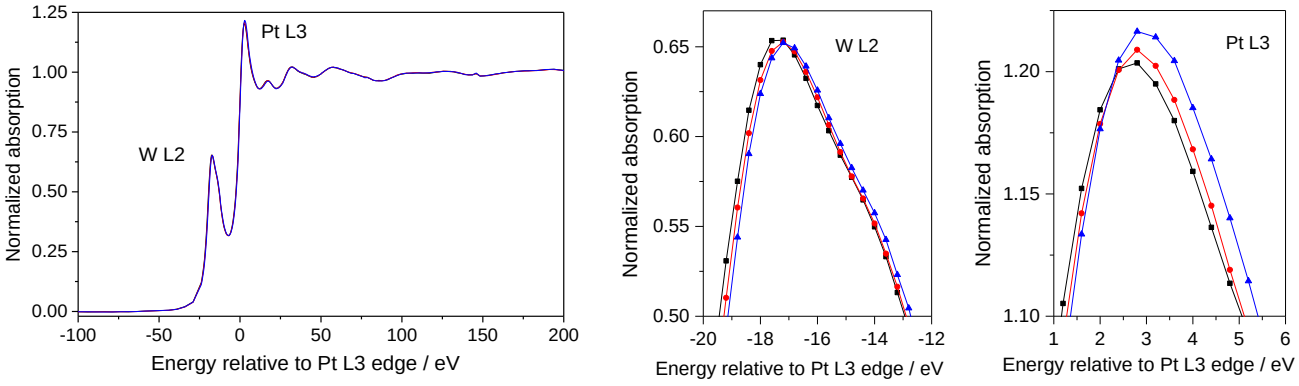


**Fig. S7** Normalized *in situ* XAS spectra for $Pt/WO_3/C$ obtained in 0.5 M $H_2SO_4$ and regions of maximum intensity enlarged. Applied potential: 0.55 V (black), 0.80 V (red) and 0.90 V (blue).

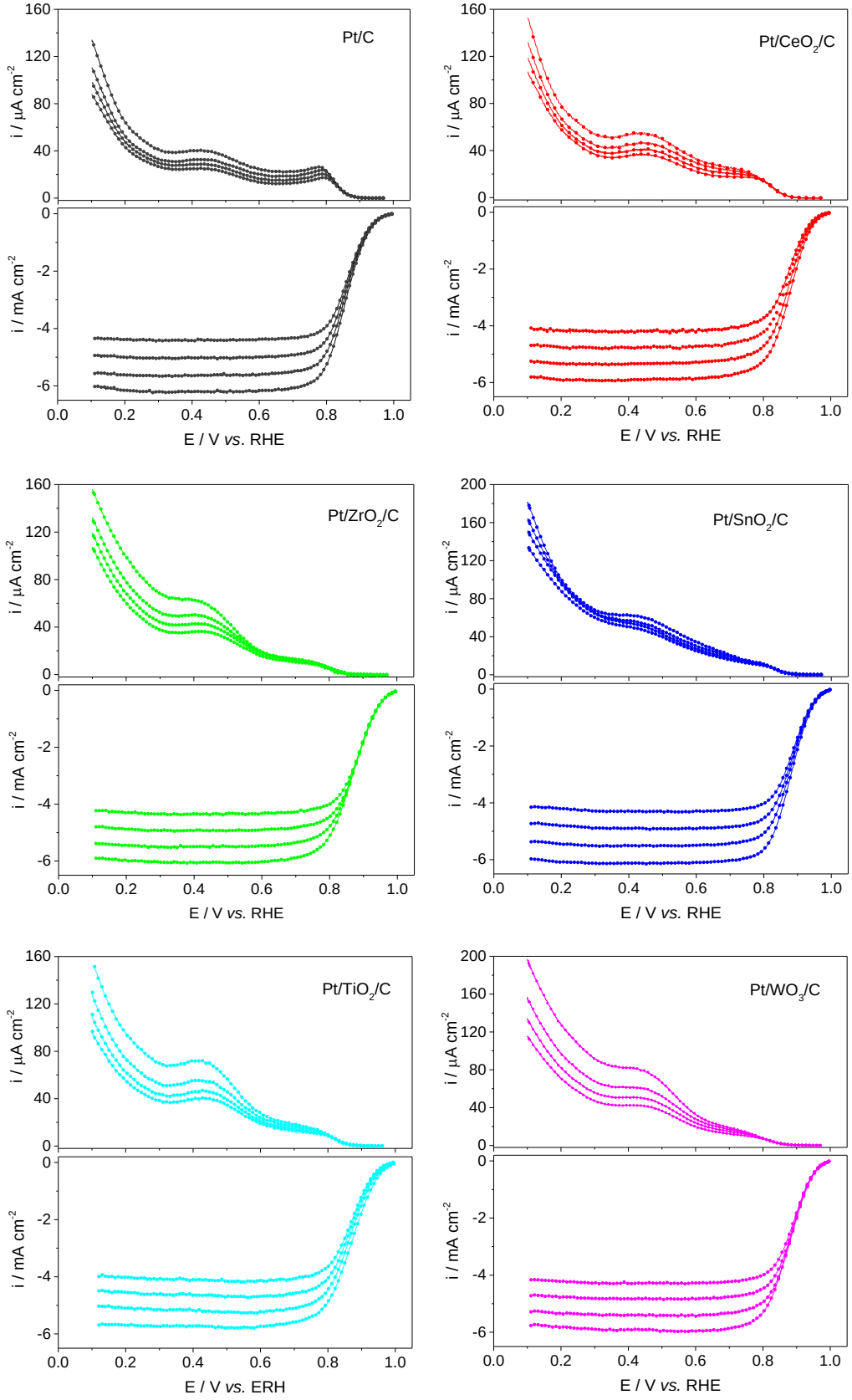


**Fig. S8** Current densities of oxygen reduction and $H_2O_2$ oxidation measured in 0.1 M KOH solution at rotation rates of 1225, 1600, 2025 and 2500 rpm. Currents are presented normalized by the geometric areas of the electrodes (0.247 $cm^2$ for disk and 0.187 $cm^2$ for ring). RRDE collection efficiency: 0.37.

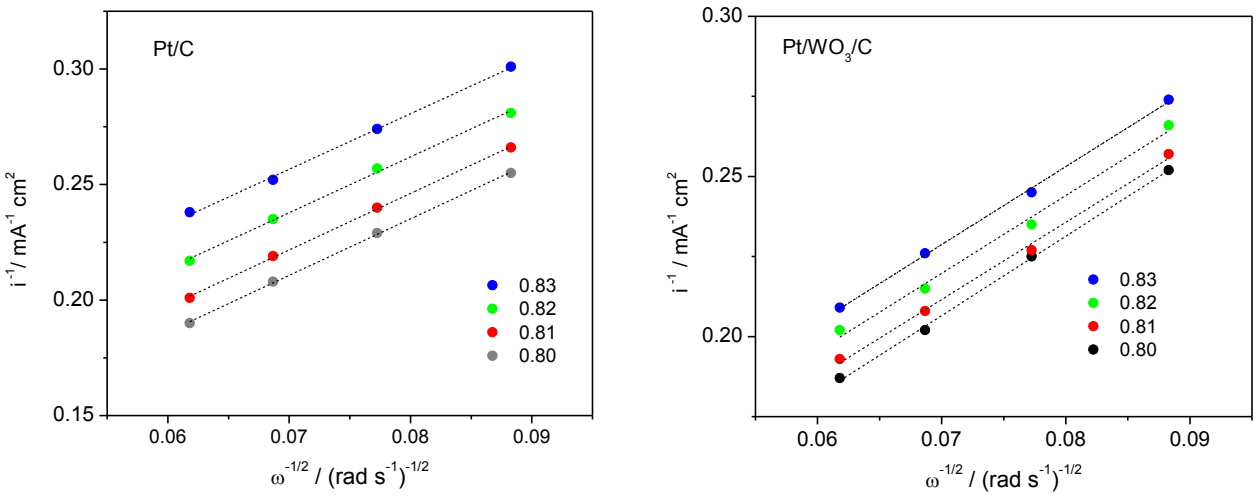


**Fig. S9** Koutecky-Levich plots for Pt/C and Pt/$WO_3$/C catalysts constructed from disk currents at different potentials. Electrolyte: 0.1 M KOH. The number of electrons was estimated using Co= 1.15 $10^{-6}$ g mol $cm^{-3}$, D= 1.9 $10^{-5}$ $cm^2$ $s^{-1}$ and ν= 1.9 $10^{-2}$ $cm^2$ $s^{-1}$.

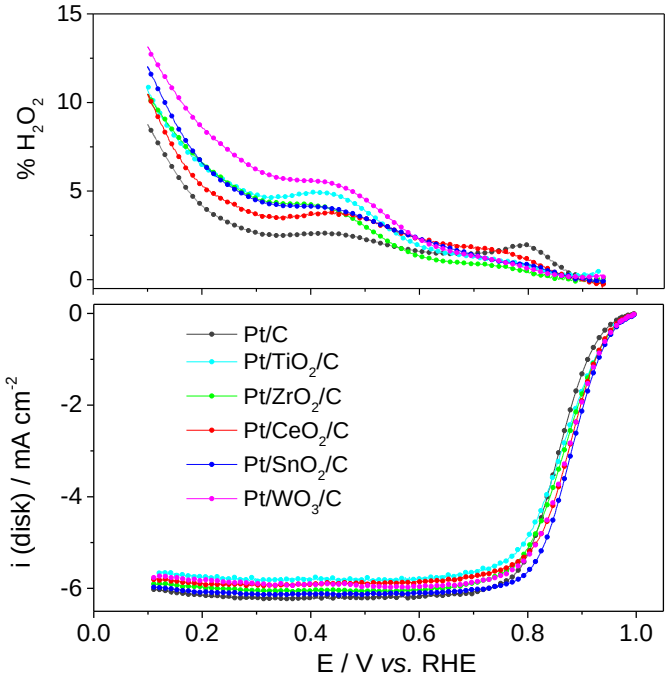


**Fig. S10** ORR polarization curves measured at the disk electrode and $H_2O_2$ yield in 0.1 KOH solution Scan rate: 5 mV $s^{-1}$. Rotation rate: 2500 rpm.

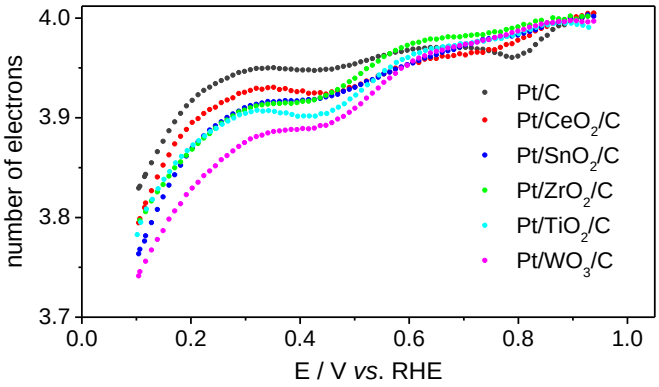


**Fig. S11** Number of electrons calculated from RRDE currents measured in 0.1 M KOH solution as a function of potential.

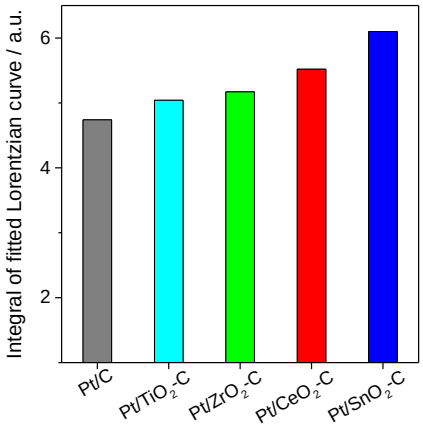


**Fig. S12** Values of the integral of the Lorentzian curve adjusted to the XAS spectra measured *in situ* in 0.1 M KOH with applied potential of 0.90 V.