

Electronic Supporting Information

Electrochemical impacts of sheet-like hafnium phosphide and hafnium disulphide catalysts bonded with rGO sheets for bifunctional oxygen reactions in the alkaline electrolytes

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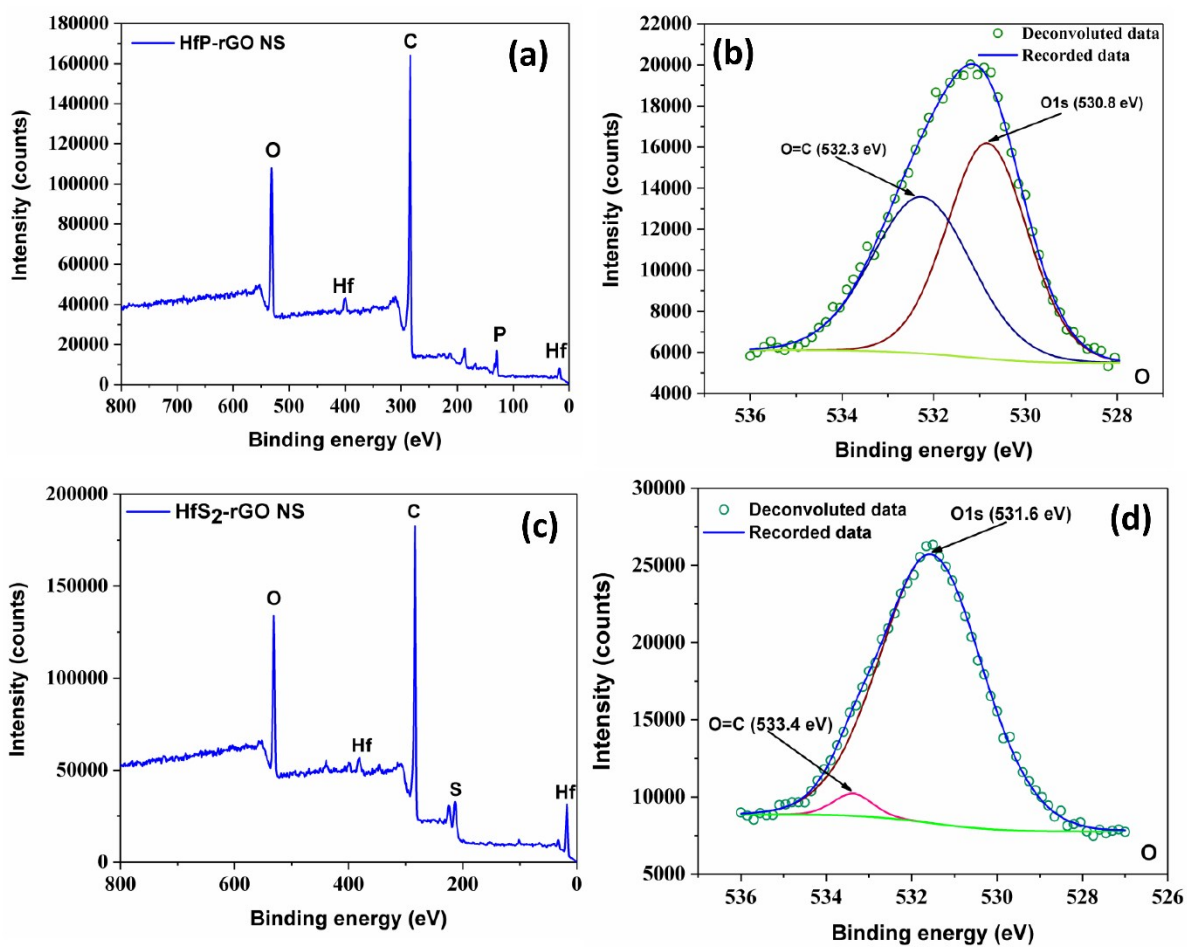


Fig. S1. (a) XPS spectra and (b) high-resolution oxygen spectra of HfP-rGO nanosheets. (c) XPS spectra and (d) high-resolution oxygen spectra of HfS₂-rGO nanosheets.

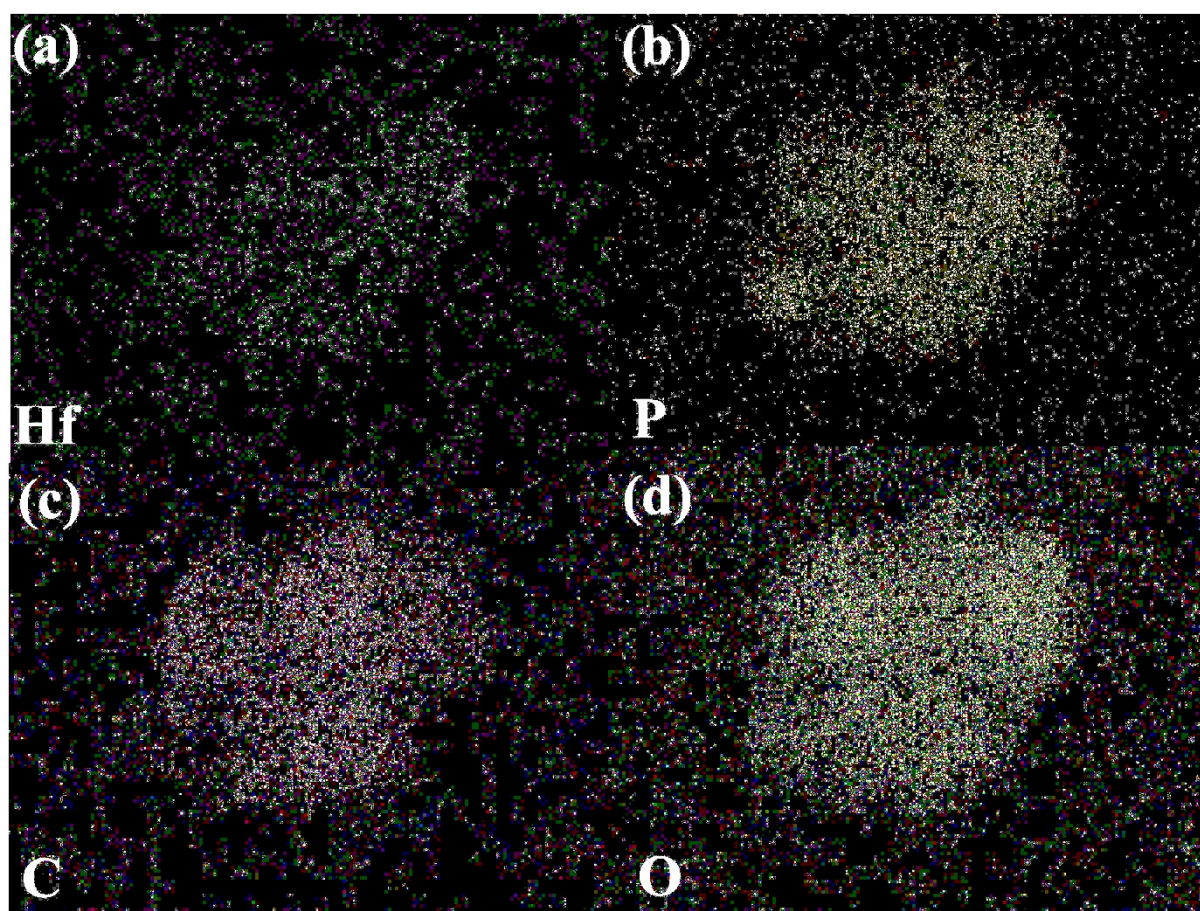


Fig. S2. SEM elemental mappings of (a) hafnium, (b) phosphorus, (c) carbon and (d) oxygen for HfP-rGO nanosheets.

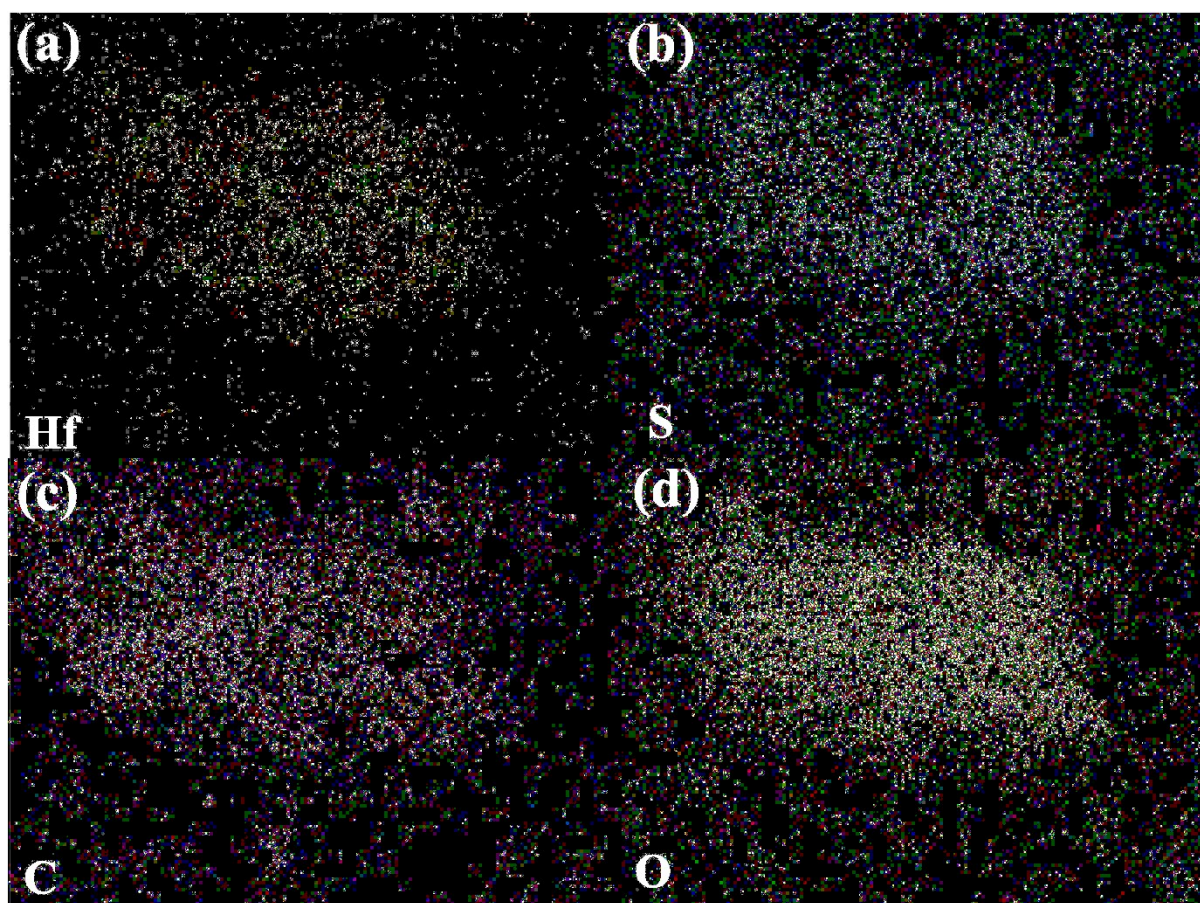


Fig. S3. SEM elemental mappings of (a) hafnium, (b) sulphur, (c) carbon and (d) oxygen for **HfS₂-rGO nanosheets**.

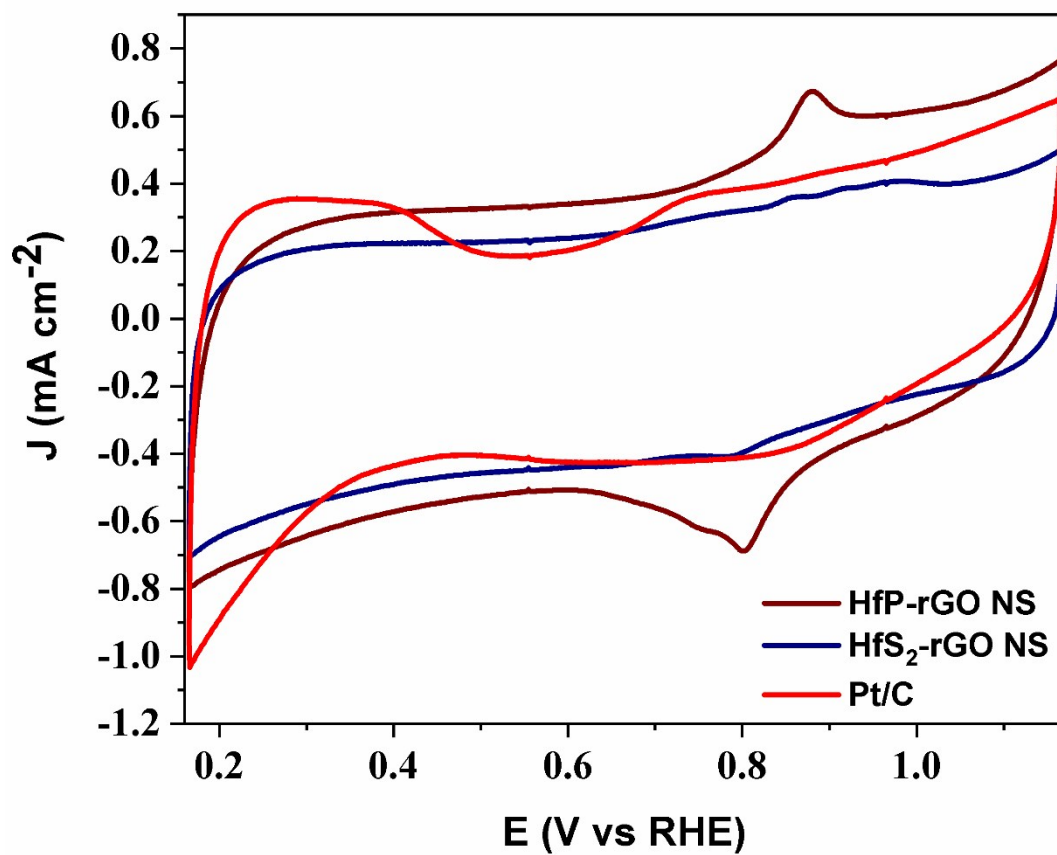


Fig. S4. Cyclic voltammograms of ORR of HfP-rGO NS, HfS₂-rGO NS and Pt/C in N₂-saturated 0.1 M KOH electrolyte at a sweep rate of 20 mV s^{-1} .

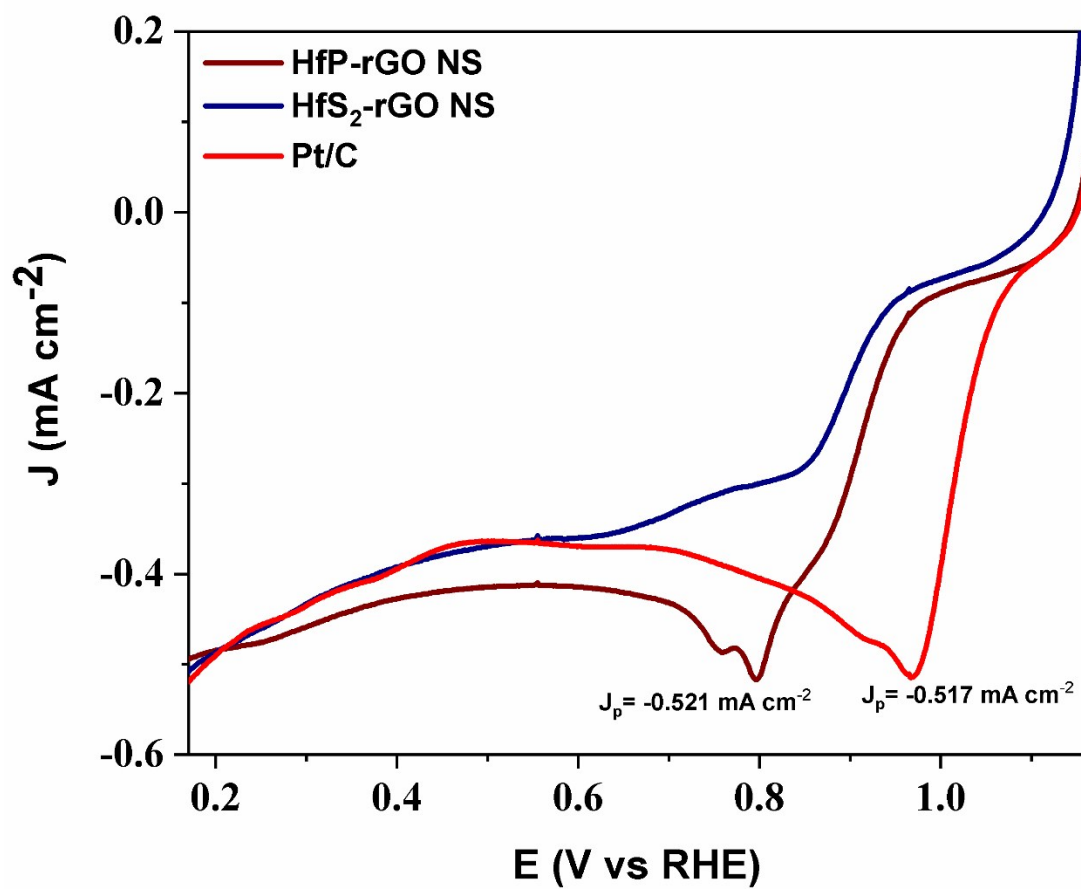


Fig. S5. Linear sweep voltammograms of HfP-rGO NS, HfS₂-rGO NS and Pt/C at a sweep rate of 5 mV s⁻¹ during the ORR.

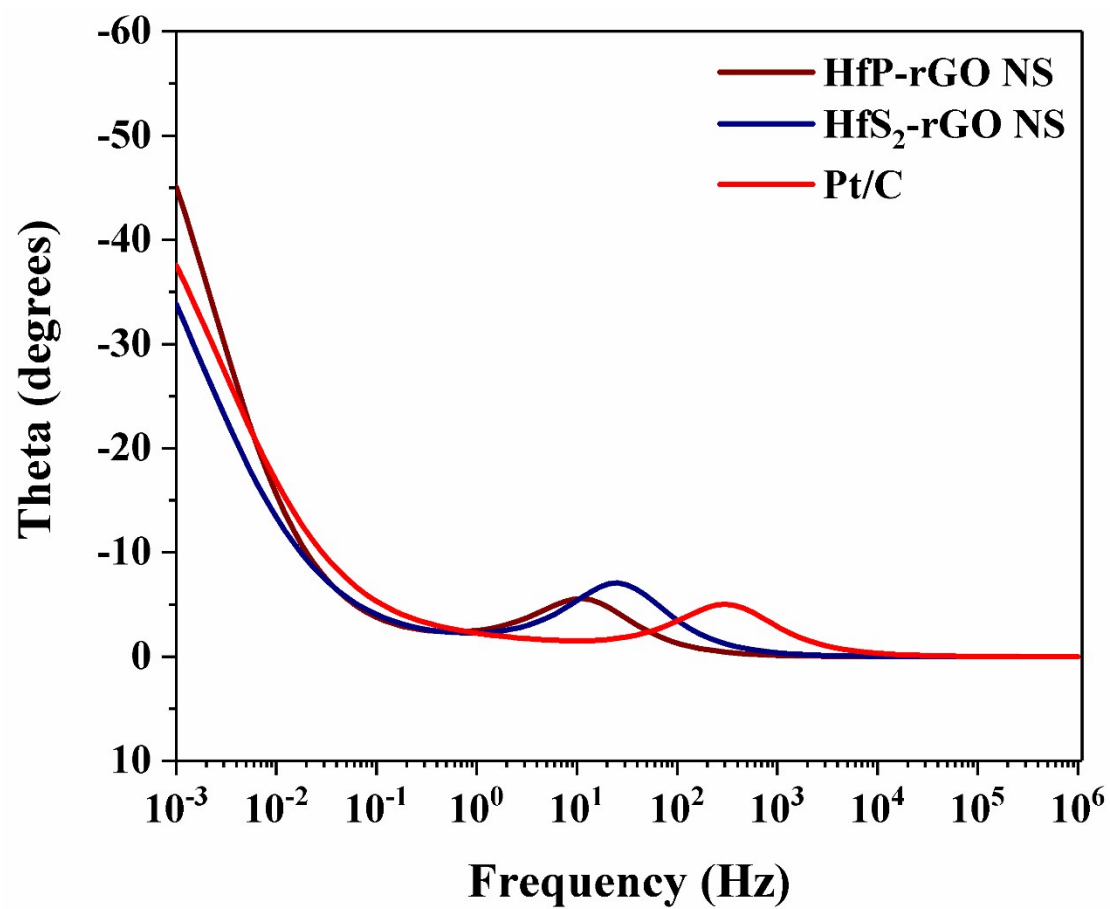


Fig. S6. Bode plots of HfP-rGO NS, HfS₂-rGO NS and Pt/C for oxygen reduction reaction.

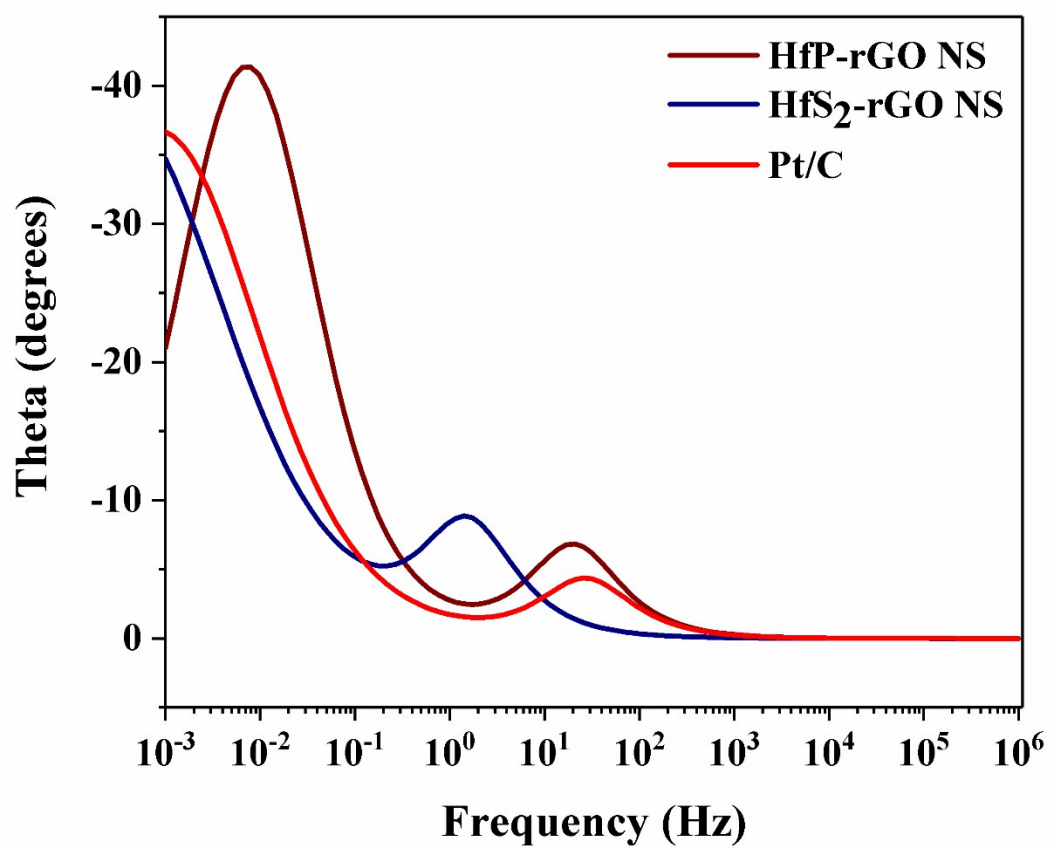


Fig. S7. Bode plots of HfP-rGO NS, HfS₂-rGO NS and Pt/C for oxygen evolution reaction.