

Hydrated FePO<sub>4</sub> nanoparticles supported on P-doped RGO shows enhanced ORR activity compared to its dehydrated form in an alkaline medium.

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**Supporting Information**

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## S1: Electrochemical measurement of

### S1.1. FePD@PRGO.

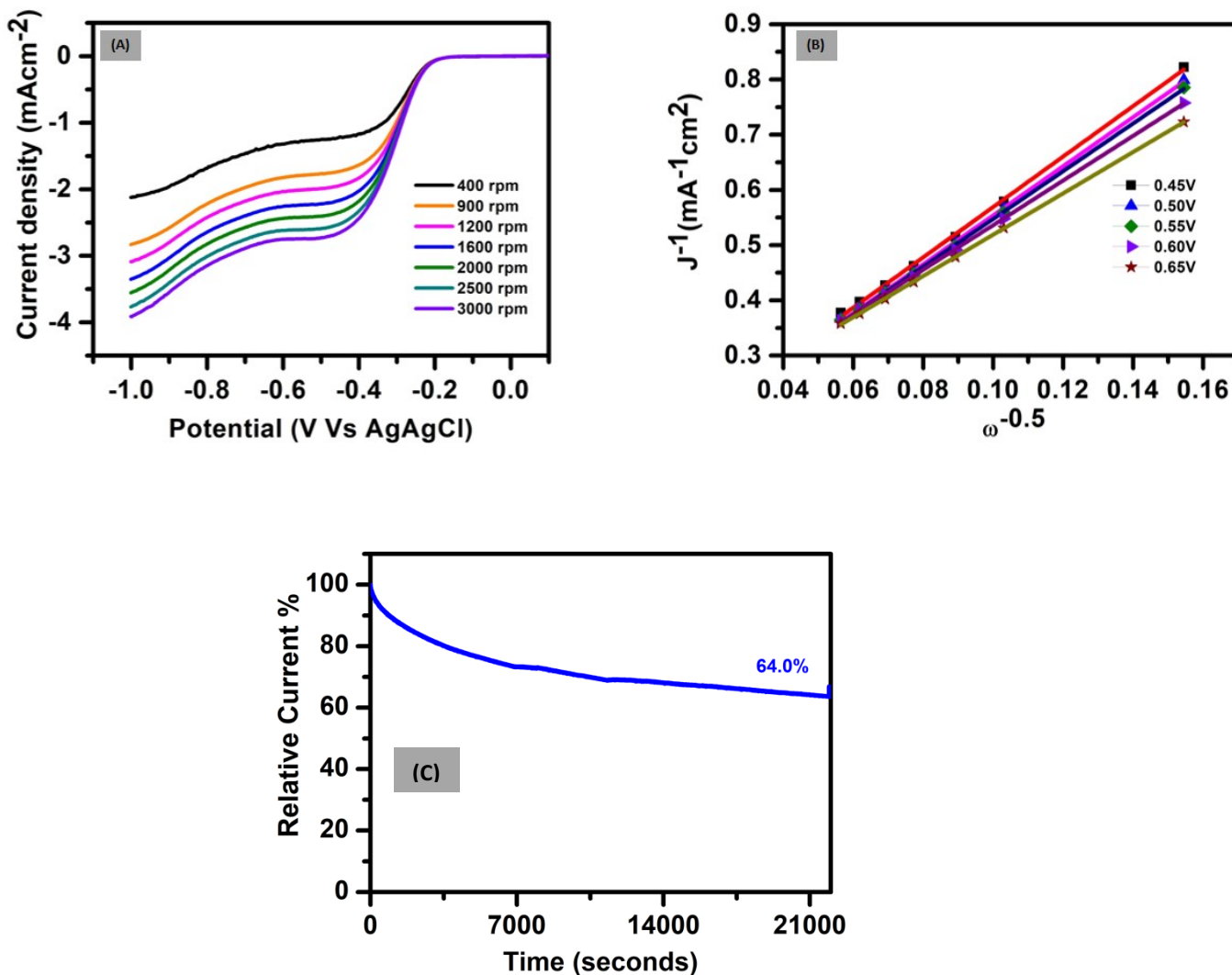


Figure S1.1: (A) LSV curve at different rotation rates (B) the corresponding Koutechy Levich plots obtain from the RDE measurements (C) chronoamperometry measurement for 22000 sec performed at -0.6 V of FePD@PRGO.

Koutechy levich (K-l) was plotted ( $J^{-1}$  vs  $\omega^{-1/2}$ ) according to the following equations given as

$$j^{-1} = j_k^{-1} + B^{-1} \omega^{-0.5}$$

Where  $J$  is measured current density,  $J_k$  is kinetic current density,  $\omega$  is the rotation per second.  $B$  is the levich constant.

## S1.2. P-doped Reduced Graphene Oxide (PRGO)

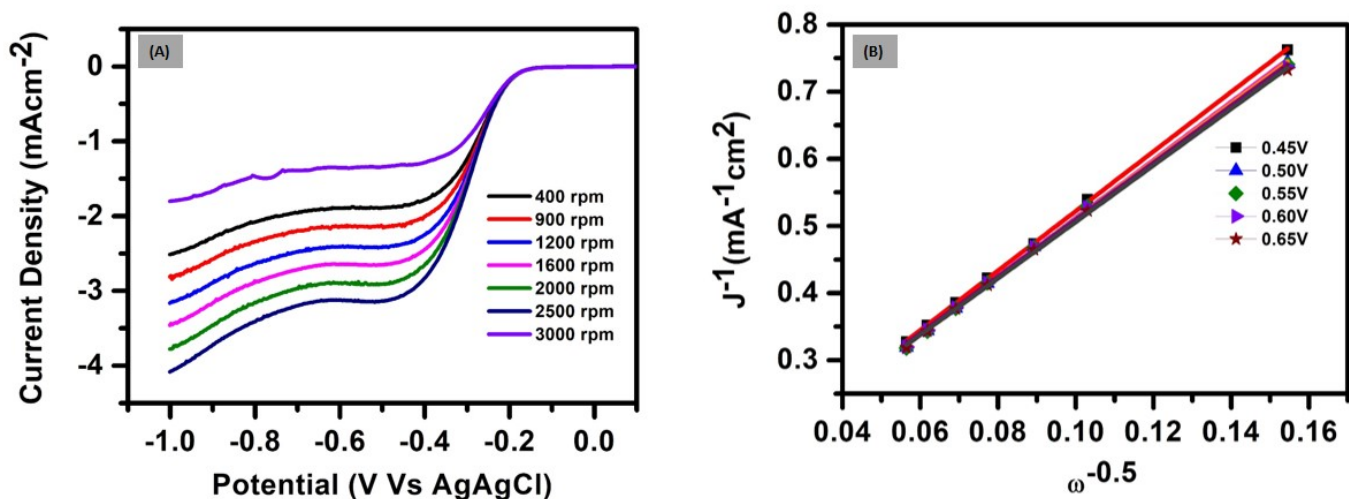


Figure S1.2: (A) LSV at different rotation rates of PRGO (B) The corresponding Koutechy Levich plots obtain from the curve.

### S2: Supplementary Table1: Electrochemical ORR performance of FePH@PRGO, FeD@PRGO, PTC and PRGO catalyst.

Electrocatalysts	$E_{\text{onset,ORR}}$ (V) Vs Ag/AgCl	$E_{\text{ORR}}$ (V) Vs Ag/AgCl (-3mA cm <sup>-2</sup> ) at 1600 rpm	Limiting current density (mAcm <sup>-2</sup> ) at 1600 rpm (-0.95V)
PTC-20%	--	-0.20	-5.61
FePH@PRGO	-0.140	-0.50	-5.61
FePD@PRGO	-0.143	-0.88	-3.22
PRGO	-0.136	-0.85	-3.30

### S3: XPS spectra of FePH@PRGO

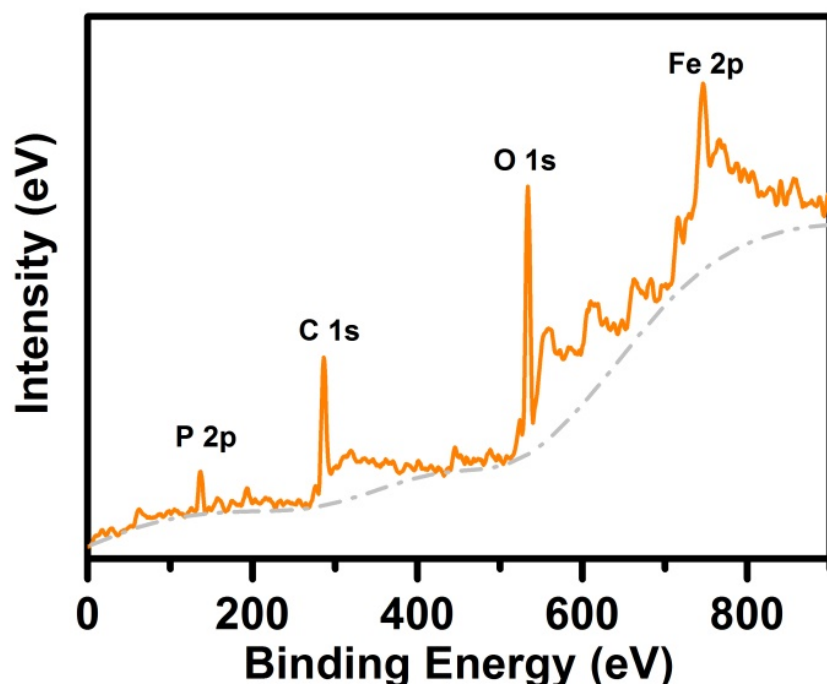


Figure S3: X-ray Photoelectron Spectroscopy (XPS) survey spectra of FePH@PRGO.

#### S4: BET isotherm.

For BET N<sub>2</sub> adsorption-desorption isotherm, samples were degassed at 50°C for 6 hrs before analysis. The pore size distribution was analysed using BJH pore model. During the annealing of FePH@PRGO, water molecules are removed which results in the formation of the porous structure thereby increasing the surface area in FePD@PRGO. Hence exhibits a larger surface area. [1]

Reference: [1] Jegal, Jong-Pil, Jin-Go Kim, and Kwang-Bum Kim. "One-pot synthesis of FePO<sub>4</sub>•H<sub>2</sub>O/carbon nanotube coaxial nanocomposite for high rate lithium ion batteries." *Electrochemistry Communications* 30 (2013): 87-90.

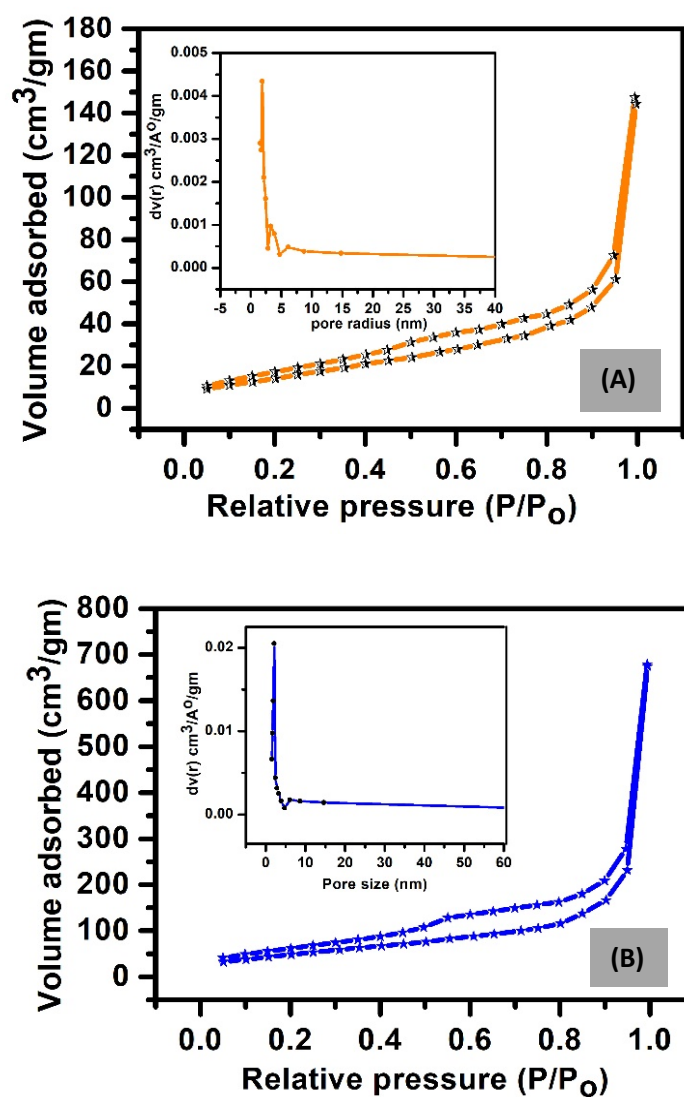


Figure S4. Nitrogen adsorption- desorption isotherm of (A)FePH@PRGO (B) FePD@PRGO

### S5. Morphology of FePD@PRGO.

Morphology of FePD@PRGO obtained after annealing FePH@PRGO at 300°C for 30 minutes in an inert argon atmosphere to prevent any chemical changes in the catalyst which is verified by TEM images (Figure S5).

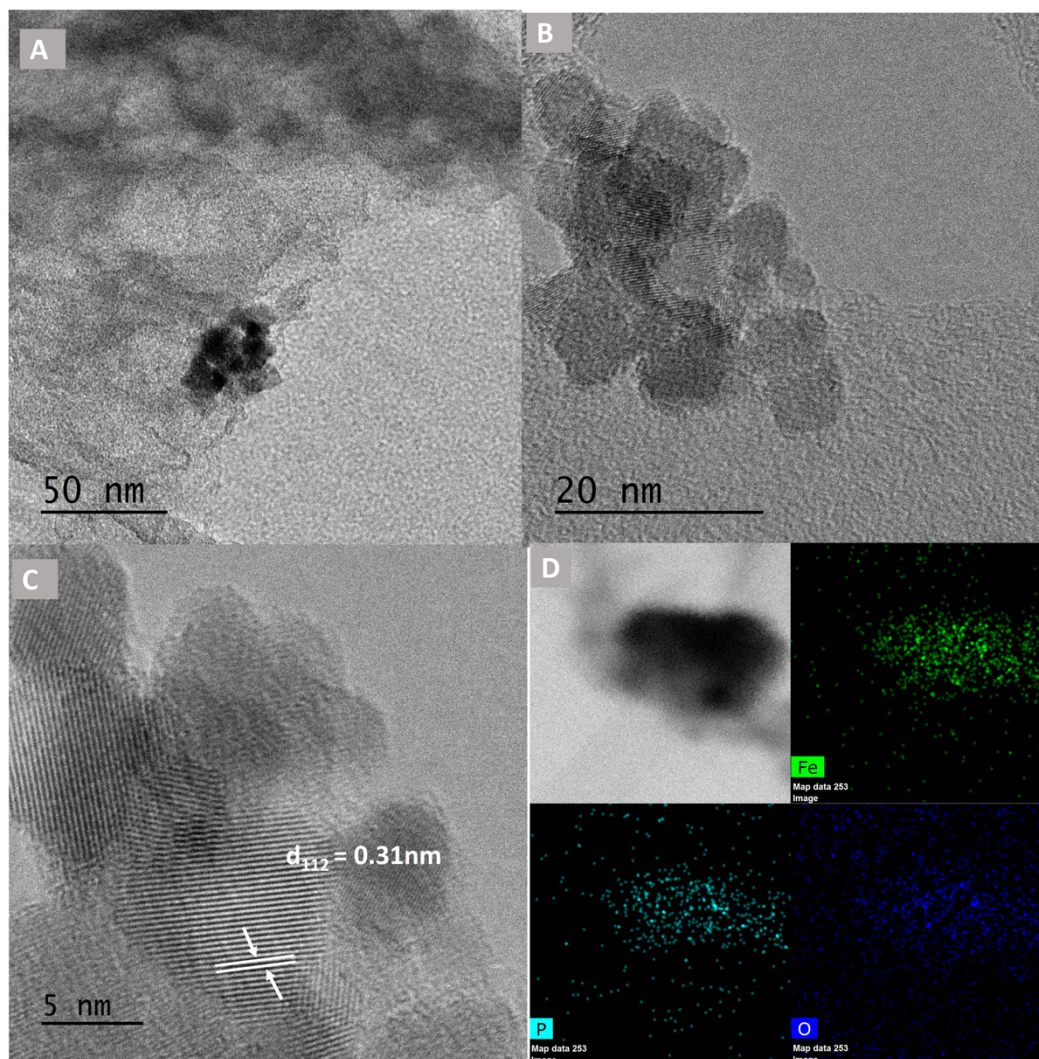


Figure S5. TEM images (A) and (B) of FePD@PRGO (C) High resolution TEM (D) STEM and corresponding elemental mapping of FePD@PRGO.

### S6. Elemental mapping and EDAX plot to determine the P doping in RGO.

The phosphorous doping in RGO is verified by both qualitatively and quantitatively by elemental mapping and EDAX plot. The binding energy plot shows that P doping has taken place in RGO with an approximate percentage of 1.28 % as shown in Figure S6.



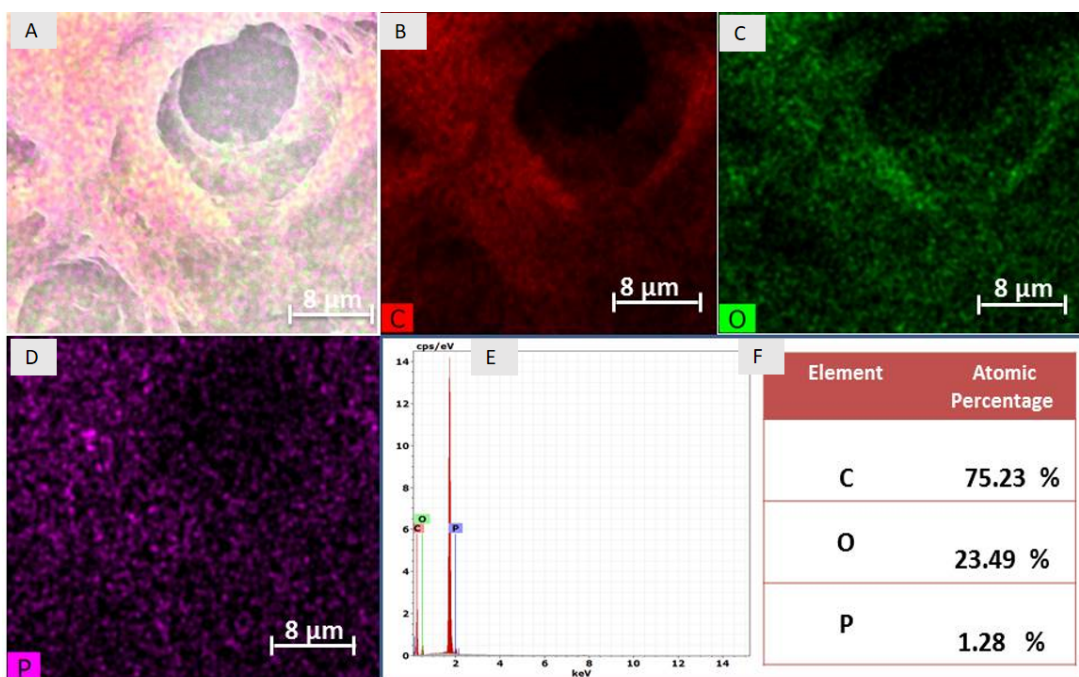


Figure S6. SEM-Elemental mapping (A) mixed map (B) Carbon (C) Oxygen (D) Phosphorous (E) EDAX spectrum (F) atomic percentage of PRGO

### S7. Morphological stability after the catalytic reaction.

The electrocatalyst after the stability measurement is recovered from electrode surface for morphological studies. The TEM analysis shows no change in morphology (Fig. S7).

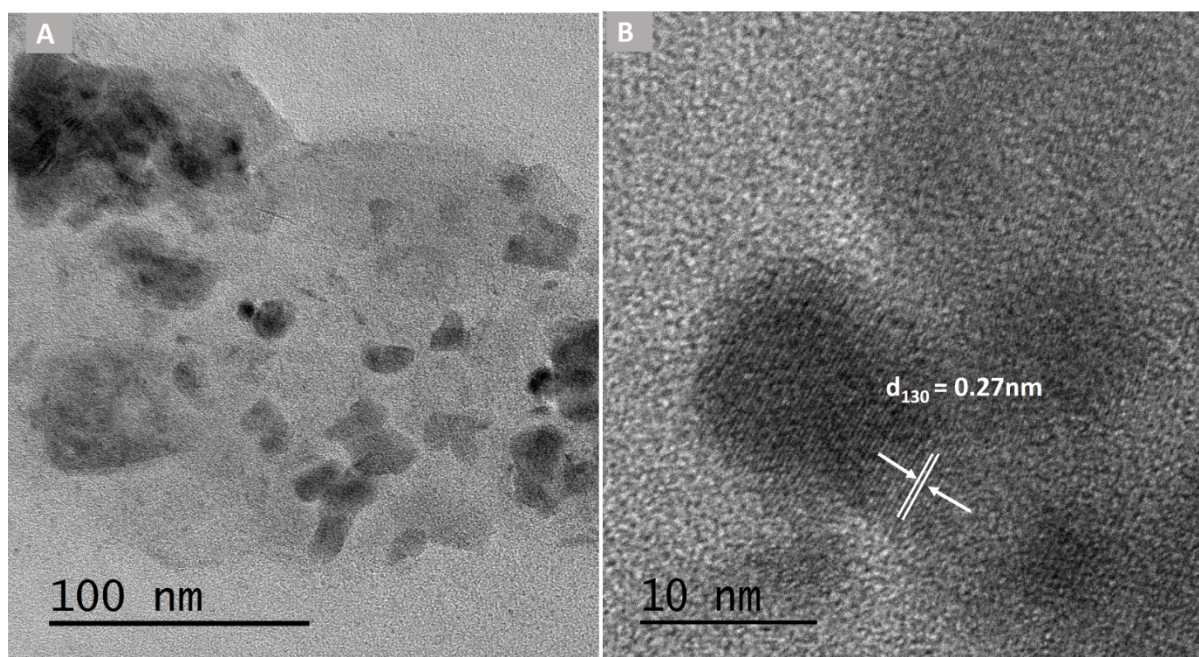


Figure S7. (A)TEM (B)HRTEM of FePH@PRGO after electrochemical stability measurement.