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Robust fused aromatic pyrazine-based two-dimensional network for stably cocooning iron nanoparticles as an oxygen reduction electrocatalyst

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Because of unique features such as low density [1], structural diversity [2], chemical and thermal stability.[3] Fused aromatic porous organic networks (FA-PON) have attracted huge interest from the scientific community. Here, we report a new FA-PON synthesized by condensation reaction between hexaketocyclohexanone (HKH) octahydrate and triphenylene hexamine (TPH). The structural elucidation was done by using different techniques, which exhibit the chemical formula of the building block to be $C_{24}N_6$ (C_4N), with excellent chemical and thermal stability. Having six nitrogen atoms each hole is capable of efficient fixing and encapsulating iron nano particles, resulting into a durable indirect-contact catalyst for the oxygen reduction reaction (ORR).[4] The catalyst (Fe@FA-PON) exhibits good electrocatalytic activity with durability in both acidic and alkaline media. However, the catalyst exhibits unusual ORR activity with half wave potential of 0.884 V, which is 38 mV positive shift compared to that of commercial Pt/C in alkaline medium.

References

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Figure: Schematic illustration of the structural development of the Fe/Fe₃C@C₄N₁ catalyst, showing the formation of Fe₃O₄@C₄N₁ by reduction of FeCl₃ with NaBH₄ and the subsequent annealing of Fe₃O₄@C₄N₁ into Fe/Fe₃C@C₄N₁.