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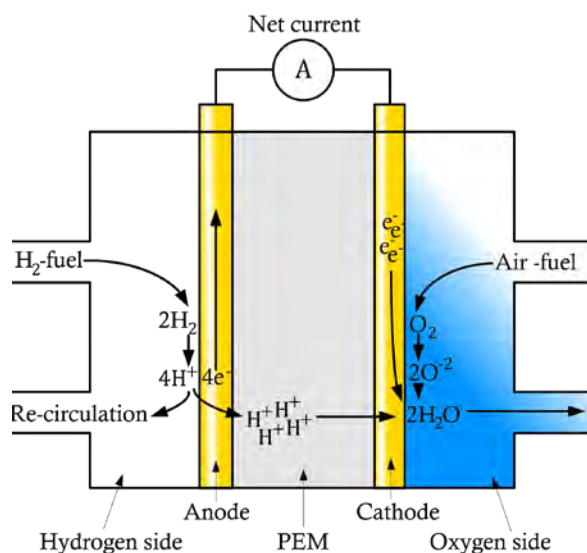
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Abstract

The emergence of technologies for efficient zero-emission energy conversion using hydrogen Fuel Cells (FCs) holds great potential for future sustainable energy schemes.



This work aims at investigation and improvement of existing FC research platforms by tuning catalysts for the Oxygen Reduction Reaction (ORR) for Proton Exchange Membrane (PEM) FCs applications. The overall project aims at identifying catalysts for High Temperature (HT) PEMFCs, which are resilient towards the phosphate anion poisoning associated with PolyBenzImadazole (PBI) based PEMs.

A special focus concerns the understanding and improvement of Pt-based FC cathode catalyst material for the ORR, both in terms of stability (thermally, non-oxidizable), efficiency (activity, selectivity) and costs (non-toxic, cheap and abundant non-noble, scalability), *i.e.* the material should be capable of operating in highly acidic (pH~1), phosphate rich, and heated environments (>160 °C) for improved kinetics.

Different approaches to minimizing phosphate poisoning on Pt-based catalyst have been attempted. In this work electrochemical investigations of a Pt(111) single crystal model catalyst and subsurface alloys are used to elucidate the importance of tuning surface binding energies of oxygen species for optimum activity and phosphate resilience.