Global energy demand is expected to increase by more than 50% by 2050, and there is an urgent need in developing sustainable energy supply infrastructure to meet this demand. Due to the intermittent nature of renewable energy supply (i.e. wind or solar power), energy storage technologies are crucial to secure continuous operation of power grid. Redox flow batteries have great potential for large-scale energy storage applications owing to their flexibility for scalable power and energy densities. For grid scale storage applications, it is crucial to consider the concepts of circular economy and waste minimization and use sustainable materials for batteries.

This project will aim to develop next-generation redox flow batteries using low-cost materials, such as waste sulphur materials generated from petrochemical industry. Imperial College team have patented a new generation of aqueous polysulfide-air flow battery, which is a promising battery system for low-cost, high energy density, environmentally benign batteries for grid-scale storage applications. This PhD project will study the low-cost high-capacity flow batteries and integrate electrocatalysts and new ion selective membranes. The project will develop new electrocatalysts to enhance the catalytic conversion of polysulfides and oxygen related reactions. Novel ion-selective membranes will be paired with the catalysts to enhance the cycling stability and lifetime of the flow batteries.

The PhD project will be co-supervised by Prof Anthony Kucernak in Department of Chemistry, Prof Nigel Brandon in Earth Science and Engineering, and Dr Qilei Song in Department of Chemical Engineering at Imperial.

This PhD project aligns well with the development of clean Energy and Low-Carbon technologies, and the College’s Transition to Zero Pollution initiative.

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