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Electrochemical Energy Conversion and Storage: Structure Design of Electrode and In-Situ Spectroscopic Studies

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The property of electrode in electrochemical energy conversion (Fuel cells) and storage (lithium batteries) depends strongly on the structure. On the one hand, the platinum group metals (PGMs) and Pt-based catalysts are of vital importance for fuel (organic molecules, hydrogen) oxidation to promote the efficiency of energy conversion; On the other hand, the performances of electrode materials are crucial for developing lithium ion batteries (LIBs) with high energy, high power and safety. We have focused in recent years on the structure design and controlled synthesis of both electrocatalysts for DOFCs and electrode materials for LIBs. In order to gain deep understanding on the surface/bulk processes and reaction mechanism involved in electrochemical energy conversion and storage, we have developed in situ spectroscopy methods including Sum Frequency Generation (EC-SFG), Nuclear Magnet Resonance (EC-NMR), X-ray diffraction (EC-XRD), Online electrochemical Mass Spectroscopy (OEMS), Transmission Electron Microscopy (EC-TEM), Electrochemistry-X Ray Photoelectron Spectroscopy (EC-XPS) and Fourier Transform Infrared Spectroscopy (In-situ FTIRs). This presentation will briefly introduce the key progresses of above topics.

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