Traditional and Novel Platinum/Conducting Oxide Electrocatalysts: Trends and Promise

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Fabrication and functional properties of electrocatalysts which consist of coexisting nm-size particles of platinum group metal and conducting oxide are discussed in relation to possible applications in fuel cells. The majority of experimental illustrations are related to Pt coexisting with tungsten, molybdenum, tin, and vanadium oxide. Some representative original publications [1-10] are mentioned below in respect to the following aspects addressed in the report.

(1) Principle phenomena important for electrocatalysis on metal/oxide hybride materials: highly reversible mediating electron transfer, spill over of hydrogen and oxygen and bifunctionality in relation to oxidation of organic species (for methanol and ethanol fuel cells) [2, 5, 6].

(2) Fabrication strategies providing the most stable and active metal/oxide electrocatalysts; “wet” and ‘dry” fabrication techniques are compared in the context of reproducibility, controllability, and flexibility [1, 8].

(3) Solid state characterization protocols which provide information concerning both components of hybride catalysts, as well as their mutual distribution and characteristic nanoparticles size; in particular application of *in situ* Raman spectroscopy and spectroscopic mapping in STM configuration is accented [4, 8, 9].

(4) Electrochemical characterization techniques as adapted to multicomponent materials with complex voltammetric features; this is important for correct determination of the true surface area using various UPD-based techniques [1, 6].

(5) Model 2D materials (modified electrodes) useful to clarify various mechanistic aspects for electrocatalysis; e.g. these materials can be prepared by means of molecular modification of the platinum metal surfaces, with the use of highly symmetric polyoxometalates as analogues of oxides [3, 7, 10].

Cautious estimates of the prospects of metal/oxide electrocatalysts (as compared to other types of catalysts) are presented for electrooxidation of C1 and C2 organic fuels and for electroreduction of oxygen and inorganic anions. Similarity of metal/oxide and carbide-containing catalysts is also discussed.

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