

Preface

This Volume analyzes and discusses several important recent developments in the study of interfacial phenomena at the metal/solution interface and their role in Electrocatalysis. The six chapters are written by internationally recognized experts in these areas and address both fundamental properties of the metal/solution interface and the practical implications of these phenomena in electrocatalysis.

The Chapter by N. Garcia, V. Climent and J. Feliu provides a lucid and authoritative overview of the use of laser-pulsed induced temperature variations at the platinum single-crystal/aqueous solution interphases and of the rigorous analysis of these experiments via Gibbs thermodynamics to extract new and very valuable information on the structure and reactivity of the metal/solution interphase. The authors show how some key interfacial properties can be evaluated directly via this elegant analysis, such as the entropy of charge-transfer adsorbed species, the entropy of formation of the interfacial water network and the potential of water reorientation.

The Chapter by G. Tsirlina provides a lucid historical evolution of our understanding of Pt metal electrochemistry and electrochemical surface thermodynamics from the days of Frumkin to the modern era of sophisticated surface science techniques. This exciting review links theory and experiment, poorly and well defined surfaces and the thermodynamics of adsorption with the most recent results obtained with modern in situ spectroscopic and microscopic techniques.

The amazing new horizons opened by the use of X-ray absorption Spectroscopy (XAS) for in situ or operando studies of the electrode/electrolyte interphase in a working fuel cell are presented in a lucid and concise chapter by C. Roth and D. Ramaker. It is shown how via the use of EXAFS and the newer $\Delta\mu$ XANES technique one can now monitor individually the surface concentrations of atop CO, opd and upd H, bridge-bounded and fcc O and even OH, all possibly present on Pt and PtRu surfaces during cycling in acidic PEM fuel cells media.

The Chapter by C. Bianchini provides a comprehensive and authoritative overview of recent advances on the use of Pd-based electrocatalysts in direct alcohol fuel cells. The Chapter shows lucidly how the dilution of Pd with non-noble metals in a smart catalytic architecture can lead to inexpensive and highly active anode electrodes which can knock down the main barriers for the commercialization of direct alcohol/fuel cells (DAFC).

The cathodic oxygen reduction (ORR) electrocatalysis on chalcogenides is discussed in an authoritative Chapter by N. Alonso-Vante. Several new findings are discussed related to the design, genesis and ORR mechanism on these materials which are promising catalysts for Pt replacement in the future.

A promising approach for avoiding CO poisoning of PEMFCs is higher operating temperatures and the Chapter by M. Daletou, J. Kallitsis and S. Neophytides discusses the use of new polymeric membrane materials which allow for PEMFC operation up to 180°C. This is shown to enhance anodic and cathodic electrocatalysis with minimal material degradation problems and thus appears quite promising for future practical applications.

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