Insights into Fundamentals of Electrocatalysis

Is there a common “activity yardstick” which applies to all fuel cell electrocatalysts?

Electrocatalysis can be described as a sub-field of heterogeneous catalysis, having unique fundamental aspects some of which deserve fuller recognition. Electrocatalytic processes in polymer-based fuel cells will serve in this talk to describe some key general facets of electrocatalysis. A recognized uniqueness of electrocatalysis is the ability to accelerate the electrocatalytic process at low temperature by changing the potential difference across the catalyst/electrolyte interface, simply achieved by varying the voltage across the cell. A new expression describing the rate of electrocatalytic processes (current per unit cross-sectional area) has been developed including a term that explains why and how the population of active surface sites changes strongly with change of the electrode potential. This term reflects the dependence of active site population at some potential, E, on the standard potential of the mediating surface redox system, E°. Examples of electrocatalysts for Alkaline Membrane Fuel Cells (AMFCs)–the new type low-T fuel cells being developed at CellEra will be described in light of the general principles articulated above. Best fuel cell catalysts in alkaline systems are quite different than their counterparts in acidic systems and this difference can be understood to large degree based on the above general principles.