

Correlações atividade-propriedades em eletrocatalise

Correlations activity-properties in electrocatalysis

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Precious metals such as Pt and Pd are usually the main catalysts for sluggish electrochemical reactions relevant for low temperature fuel cells, such as oxygen reduction and the oxidation of methanol and ethanol. The most common approach to enhance catalytic performance have been the combination of Pt and Pd with other transition metals, such as Fe, Co, Ru, Sn, etc. Literature data clearly show that particle size, shape, structure, composition and electronic properties of bimetallic catalysts have a considerable effect on the catalytic activity. More often than not, these properties are interdependent for nanoparticles. For instance, alloying and the amount of oxides were found to be size-dependent for PtRu/C catalysts [1], the electronic properties of Pt in carbon-supported PtFe particles were shown to be a function of composition [2], and the formation of adsorbed oxygenated species on PdAu/C was found to depend on the electronic properties [3]. In general, understanding how each property affects the electrocatalytic activity is a long-standing problem. For reactions involving adsorption of reactants and/or intermediates, electronic effects are considered quite relevant because variations in the strength of adsorption may alter the reaction mechanism and, therefore, the catalytic activity. However, the impossibility of separating the effects of composition and particle size has hindered establishing clear activity-property relationships. A good experimental strategy for a rigorous control of properties is the most essential tool to allow exploring the effects of certain properties on the electrocatalytic activity while keeping others constant. In this talk, ways of controlling properties will be discussed, with emphasis in the experimental approach that takes advantage of metal-support interactions that allows having identical nanoparticles of the active metal with different electronic properties. Results showing the influence of the electronic characteristics on the activity for oxygen reduction of Pt and on the oxidation of ethanol on Pd nanoparticles will be shown and the correlations established analyzed.

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References

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