ChemE MIT Chemical Engineering

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Understanding How the Environment Around Active Sites Affects Electrocatalytic Activity

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Electrochemical processes offer an appealing way to store intermittent energy produced by renewable electricity sources and sustainably produce chemicals that are currently derived from petroleum. It is well known that the performance of these processes is affected not only by the composition and structure of the (electro)catalyst used, but also by the electrolyte in which the reaction is run. In particular, the choice of electrolyte cation markedly impacts catalytic activity for many critical reactions. But the reason behind these changes remains disputed. In this talk, I will describe a physical model we have developed that helps rationalize these effects. We propose that the electric field present at the catalyst surface is sensitive to the identity of the cation in the electrolyte. This interfacial field alters the energetics of the reaction and consequently rates. These concepts help deepen our understanding of catalysis at electrochemical interfaces and provide new tools for designing high efficiency fuel cells, electrolyzers, and electro-synthetic cells.

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