The Interface is a Tunable Dimension in Electricity-Driven Organic Synthesis

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Abstract

Predictive control over the selectivity outcome of an organic synthetic method is an essential hallmark of reaction success. Electricity-driven synthesis offers a reemerging approach to facilitate the design of reaction sequences towards increased molecular complexity. In addition to the desirable sustainability features of electroorganic processes, the inherent interfacial nature of electrochemical systems present unique opportunities to tune reaction selectivity. To illustrate this feature, we outline examples of mechanism-guided interfacial control over CO2 electroreduction selectivity, a well-studied and instructive electrochemical process with multiple reduction products that are thermodynamically accessible. These studies reveal how controlled proton delivery to the electrode surface and substrate electroadsorption with the electrode dictate reaction selectivity. We describe and compare simple, yet salient, examples from the electroorganic literature, where we postulate that similar effects predominate the observed reactivity. This perspective highlights how the interface serves as a tunable dimension in electrochemical processes, delineating unique tools to study, manipulate, and achieve reaction selectivity in electricity-driven organic synthesis.

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