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(Invited) Modeling Electrolyzers: Exploring the Applied Voltage Breakdown

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Abstract

To commercialize successfully polymer-electrolyte electrolyzers and optimize their performance, one requires a detailed understanding of the underlying physics and phenomena. Mathematical modeling is ideally suited to explore such intricacies. In this Tutorial, the modeling equations and approaches towards both proton- and hydroxide-conducting polymer electrolyzers will be detailed. This includes the introduction of the applied voltage breakdown that separates the overall polarization curve into its constitutive parts such that the limiting mechanisms can be ascertained. Throughout, different case studies will be explored including impacts of bubble generation, liquid versus vapor feed, and pH changes due to carbonate and hydroxide solution feeds. A key focus of the Tutorial will be in exploring and describing the various transport and competing phenomena within the electrolyzer cell.

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