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Electrocatalytic Reaction Driven Flow: The role of pH on flow reversal. ABIMBOLA ASHAJU, VEERLE OTTEN, JEFFERY WOOD, ROB LAMMERTINK, Univ of Twente — Bimetallic nanorods move autonomously within an aqueous solution through self-electrophoresis. They can be immobilized in the form of a micropump to generate fluid flow which is driven from the anode to the cathode similar to an electroosmotic flow. However, under low reactive regimes, the flow becomes fully reversed. This work unravels the origin and dynamics of this flow hysteresis through a combined experimental and numerical approach. The key electrocatalytic parameters that contribute to flow reversal, including electrode switch, are analyzed under low reactive regimes induced by pH variations. The proton gradient that initiates electrocatalytic actuation is probed using fluorescence lifetime imaging. The fluid flow and electric field are quantified using the two-particle phoresis correlation. Our numerical simulations elucidate the role of pH variations and additional ionic species (counterions) towards flow reversal. The combination of these techniques highlights the interplay between these electrokinetic phenomena in conjunction with the bielectrode zeta potential towards flow reversal. Our work contributes towards the fundamental understanding of fluid flow powered by an immobilized electrocatalytic micropump that applies to mass transport enhancement in electrochemical systems.

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