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Surface Reaction Driven Flow ABIMBOLA ASHAJU, JEFFERY WOOD, ROB LAMMERTINK, University of Twente — Bimetallic nanorods in form of microswimmers within an aqueous solution exhibits self-propulsion that is powered by self-electrophoresis. This bimetallic catalytic system can be immobilized to generate convective flow thereby acting as a micropump. In this work, we focus on experimental and numerical analysis that provides fundamental insight on the key elements including the generated electric field, reaction kinetics and diffusio-electroosmotic phenomena that control the resulting mass transport characteristics in these systems. The catalytic current between the electrodes and the induced potential that governs the reactive fluxes are measured electrochemically, proton concentration gradients originating from the catalytic reaction are imaged and quantified using fluorescence lifetime imaging, while the fluid flow is visualized with 3D particle tracking. Numerical simulations reveals the interplay of electrodes surface reactivity pattern represented by the dimensionless Damkhler number, with the electrokinetic phenomena that controls the release and depletion of protons and consequently the resulting induced fluid flow. This work highlights the ability of surface induced convective fluid flow in electrochemical systems to reduce mass transport limitations.

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