

Abstract Submitted
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Characterizing structural overpotentials for bubble evolution on nanostructured semiconductor-electrocatalyst interfaces ROBERT H. CORIDAN, Department of Chemistry and Biochemistry, University of Arkansas — Nanostructured electrocatalysts can improve the kinetics of solar-driven photocatalysis at a semiconductor-liquid junction while minimizing the effect on the energetics of that junction. A relevant example is Pt-decorated Si electrodes for hydrogen evolution from water splitting. Nanostructuring can also impair the reaction kinetics by introducing mass transport overpotentials. For reactions that evolve gas, the active surface area can be blocked by bubbles on discrete catalytic sites, possibly halting the reaction entirely. Here, we explore these issues by measuring the high-frequency dynamics of bubbles evolved from nanostructured electrocatalysts at a semiconductor-electrolyte interface. Using transmission x-ray phase contrast microscopy, we can image gas-evolving reactions as a way to directly measure the effects of adhesion, catalyst structure, and buoyancy on the reaction kinetics. From these measurements, we develop a model for electrolytic bubble evolution and transport that considers coalescence on neighboring sites, surface interactions, and the non-equilibrium shape dynamics of bubbles. This model can be used to identify favorable catalyst motifs that promote bubble clearance and mitigate their influence on reaction kinetics for water splitting applications.

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