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Effect of electrolyte flow on bubble growth and detachment during electrocatalytic hydrogen evolution

Abstract:

The effect of electrolyte flow on the bubble evolution in electrochemical water splitting was investigated by a high-speed camera system and bubble force balance modeling analysis. As the flow rate increased, the precipitation efficiency during bubble growth decreases gradually. A semi-theoretical and semi-empirical formula for bubble growth in flowing electrolytes was derived to describe the effect of electrolyte flow on the bubble growth process. With the increase of current density, the radius of the bubbles gradually increases, while the number of bubbles produced per unit time first increases and then decreases. The fluctuation range of the electrolysis voltage decreases with the enhancement of the flow. The bubble force balance was modeled analytically, and the analysis revealed two modes of flow influence. At low flow rates, bubble detachment is mainly determined by the force balance in the vertical direction, and as the flow rate increases, the flow drag force on the bubble in the horizontal direction gradually increases, and the bubble detachment gradually shifts to be determined by the force balance in the horizontal direction. In the low-flow region, the bubble detachment radius and electrolytic voltage increase with the increase of flow, and in the high-flow region, the bubble detachment radius and electrolytic voltage decrease with the increase of flow. These findings are important for minimizing the effect of bubble effect on electrolysis efficiency.

Biography

Yang Lin is a PhD student at the School of Chemical Engineering and technology, Tianjin University. He received his bachelor's degree in 2017 and his master's degree in 2020 from Tianjin University. His main research interests are three-phase reactive interfacial destabilization and two-phase flow transfer processes in water electrolysis reactions.