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# Dynamics of single bubble departure from $TiO_2$ nanorod-array photoelectrode

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## Abstract

Bubble evolution from photo(electro)catalytic water splitting plays a vital role in the interfacial mass transport on photocatalyst surface. However, little success has been achieved to optimize this process, restricted by the poor understanding. Herein, taking photoelectrochemical (PEC) water splitting over a titanium dioxide ($TiO_2$) nanorod-array electrode as a model system, experiments were performed to study single oxygen bubble dynamics by combining electrochemical measurement and high-speed microscopic imaging. The experimental results indicate that the departure of bubble from photoelectrode is retarded by light irradiation, but the traditional bubble departure criterions fail to predict the bubble departure diameters especially in high light intensity. Additional analysis reveals that the light irradiation causes the Marangoni force acting on the evolving bubble, because it induces temperature rise and generates dissolved gas. A modified force balance model for bubble departure from photoelectrode was developed by adding Marangoni force. This modified model that takes account of the light-induced temperature rise and the dissolved gas, agrees well