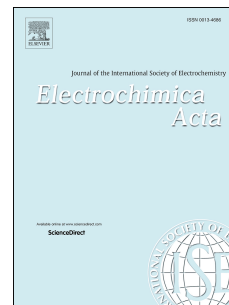


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Dynamics of single bubble departure from TiO₂ nanorod-array photoelectrode

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1 **Dynamics of single bubble departure from TiO₂ nanorod-array photoelectrode**

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7 **Abstract**

8 Bubble evolution from photo(electro)catalytic water splitting plays a vital role in the
9 interfacial mass transport on photocatalyst surface. However, little success has been
10 achieved to optimize this process, restricted by the poor understanding. Herein, taking
11 photoelectrochemical (PEC) water splitting over a titanium dioxide (TiO₂)
12 nanorod-array electrode as a model system, experiments were performed to study
13 single oxygen bubble dynamics by combining electrochemical measurement and
14 high-speed microscopic imaging. The experimental results indicate that the departure
15 of bubble from photoelectrode is retarded by light irradiation, but the traditional bubble
16 departure criterions fail to predict the bubble departure diameters especially in high
17 light intensity. Additional analysis reveals that the light irradiation causes the
18 Marangoni force acting on the evolving bubble, because it induces temperature rise and
19 generates dissolved gas. A modified force balance model for bubble departure from
20 photoelectrode was developed by adding Marangoni force. This modified model that
21 takes account of the light-induced temperature rise and the dissolved gas, agrees well

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