

# Accepted Manuscript

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PII: S0013-4686(18)31138-1

DOI: [10.1016/j.electacta.2018.05.105](https://doi.org/10.1016/j.electacta.2018.05.105)

Reference: EA 31891

To appear in: *Electrochimica Acta*

Received Date: 26 April 2018

Revised Date: 14 May 2018

Accepted Date: 15 May 2018

Please cite this article as: C. Haisch, C. Günnemann, S. Melchers, M. Fleisch, J. Schneider, A.V. Emeline, D.W. Bahnemann, Irreversible surface changes upon n-type doping – A photoelectrochemical study on rutile single crystals, *Electrochimica Acta* (2018), doi: 10.1016/j.electacta.2018.05.105.

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# Irreversible surface changes upon n-type doping – A photoelectrochemical study on rutile single crystals

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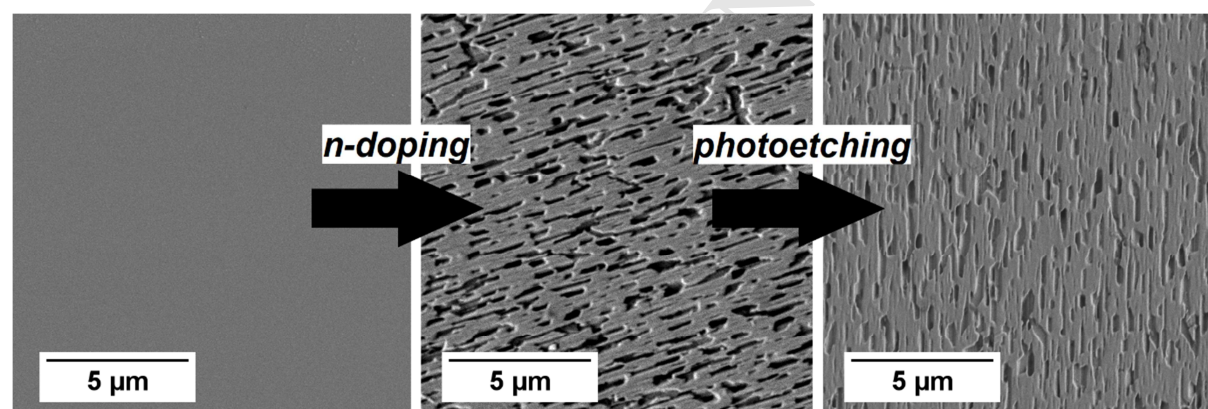
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**Key Words:** single crystal, rutile, titanium dioxide photocatalysis, photoelectrochemistry, methanol oxidation, n-type doping, photoetching

## Abstract:



Single crystal wafers need to provide sufficient electrical conductivity to be employed in photoelectrochemical investigations. Usually, their defect concentrations and donor densities are too low to allow electrochemical measurements. Accordingly, TiO<sub>2</sub> rutile single crystal surfaces have to be n-type doped before their electrochemical activity can be evaluated. The doping itself, however, leads to irreversible changes in the surface morphology of the initially smooth crystalline surfaces. In this study, the effects of n-type doping and photoetching on TiO<sub>2</sub> rutile single crystal surfaces have been investigated. The photocatalytic and photoelectrochemical activities of the rutile single crystal wafers have been quantified by methanol photooxidation. The results indicate that n-type doping has different impacts on the employed rutile (100) and (110) surfaces. Subsequent photoetching is necessary to achieve comparable donor densities for both single crystal electrodes. Moreover, the rutile (100) surface is producing different product ratios depending on the applied external bias as compared with the rutile (110) surface for methanol and water oxidation.

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