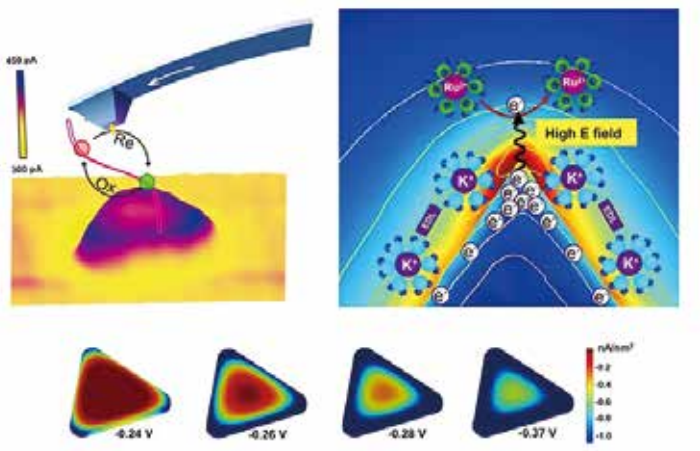
Scientists Capture Electron Transfer Image in Electrocatalysis Process

The involvement between electron transfer (ET) and catalytic reaction at the electrocatalyst surface makes the electrochemical process challenging to understand and control. How to experimentally determine ET process occurring at the nanoscale is important to understanding the overall electrochemical reaction process at active sites.

As reported in the Oct. 14 issue of *Nano Letters*, a research group, led by Prof. LI Can and Prof. FAN Fengtao from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS), captured the electron transfer imaging in the electrocatalysis process.

The researchers established an *in situ* electrochemical imaging method with nanoscale spatial resolution, which combined atomic force microscopy and scanning electrochemical imaging. This method can realize the three-dimensional movement of the scanning nanoprobe to map the local distribution of the generated outer-spherical electron transfer molecules and the catalytic product molecules.



Electron transfer current followed the trend: corner> edge> basal plane, driven by the interfacial inner potential differences (Imaged by NIE Wei and FAN Fengtao)

The visual electron transfer images on metal nanoplates directly demonstrated that the electron transfer process at the nanoscale presented site-dependent heterogeneity.

Moreover, to decouple the interference of the mass transfer effect on the electron transfer, the researchers conducted a series of elaborate experiments and complex mathematical modeling to extract the rate constant and internal potential difference. They found that the relationship between the interfacial inner potential difference and the rate constant followed a linear fashion.

This work realizes the *in situ* observation of the electron transfer process and catalytic reaction in the electrochemical reaction. It provides new ideas for developing *in situ* imaging characterization methods and the detection of the mechanism of the electrocatalytic reactions.

"This is a new milestone of the scanning electrochemical probe techniques, making it possible to discover the structure-performance relation of nanocatalyst from the bottom of physical and chemical principles," one of the reviewers commented. (Text by NIE Wei and FAN Fengtao)

(DICP)

Reference

W. Nie, Q. Zhu, Y. Gao, Z. Wang, Y. Liu, X. Wang, . . . C. Li, (2021) Visualizing the spatial heterogeneity of electron transfer on a metallic nanoplate prism. *Nano Letters* 21, 8901. doi: 10.1021/acs.nanolett.1c03529.