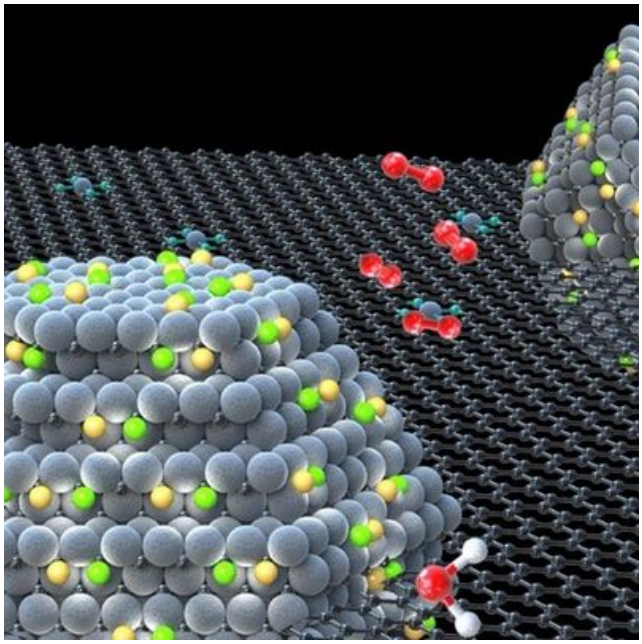
# Promising new approach: single-atom catalysts for electrochemical water splitting

Start Time: Thursday, October 28, 2021

End Time:



## Oxygen-evolving catalytic atoms on metal carbides

*Shuang Li, Bingbing Chen, Yi Wang, Meng-Yang Ye, Peter A. van Aken, Chong Cheng and Arne Thomas*

In times of climate change, researchers are vigorously looking for alternatives to petrol, gas and oil, which are harmful to the climate. The use of hydrogen as a fuel is seen as a promising solution. In this context, electrochemical water splitting is an attractive path towards clean and large-scale hydrogen production. The oxygen evolution reaction (OER) is seen as the bottleneck in this process, as it is kinetically slow and requires two steps of O–H bond breaking and subsequent O–O bond formation, including the transfer of four electrons. To enhance the efficiency of the OER, new catalysts are designed employing nanotechnology methods.

A UniSysCat team around Shuang Li and Arne Thomas now presents novel single-atom catalysts in which two metals act synergistically to yield highly active catalysts for the OER reaction. This is a significant development step, since typically, metal catalysts are strongly coordinated by oxygen or heteroatoms, which naturally affects their electronic environment and

consequently their catalytic activity. Moreover, the catalysts are composed of abundant elements only, namely Fe and Ni supported on tungsten carbide - this makes the developed catalyst easier accessible and affordable. The reported catalyst shows a low overpotential for the OER of 211 mV at 10 mA/cm$^2$, extremely high turnover frequency values of 4.96 s$^{-1}$ ( =300 mV), and good stability (1000 h). Thus, the team found an inexpensive and durable prototype for improving the OER - a great step towards developing further single-atom catalysts for electrochemical catalytic reactions, which are the basis for green chemistry and clean and large-scale hydrogen production.

Since 2015, Shuang Li has been working as a BIG-NSE scholarship holder in the Functional Materials group of Prof. Arne Thomas at the Department of Chemistry, Technische Universität Berlin. After her PhD in 2019, Shuang Li continued her work in the same group as a postdoc researcher. Her research focuses on the design and synthesis of novel hybrid materials and their applications as advanced electrode and catalytic materials. Very recently she started as a professor at the College of Polymer Science and Engineering, State Key Laboratory of Polymer Materials Engineering Sichuan University in Chengdu, China.

The findings of Li et al. are published in *Nature Materials*: S. Li, B. Chen, Y. Wang, M.-Y. Ye, P. A. van Aken, C. Cheng, A. Thomas *Nature Mat.* **2021**, 20, 1240–1247, https://doi.org/10.1038/s41563-021-01006-2