

12th International Conference and Exhibition on **Materials Science and Chemistry**
&
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Atomic scaled surface decoration promises oxygen reduction performance of nanocatalyst

Surface decoration is an effective assessment for improving chemical stability of nanocatalysts. In this study, we demonstrate that the dimension of the surface decoration can be manipulated down to atomic scale. Apart from using noble metals, atomic scaled Pt clusters were employed to improve the oxygen reduction reaction performance of catalysts. Those clusters are decorated in surface defect regions of Cocore-Pdshell (Co-Pd) nanoparticles by using self-aligned nanocrystal growth followed by atomic quench with strong reduction agent. They localize electrons from neighboring atoms and boost activity of Co-Pd NP in ORR. With a proper reaction time and loading control, the Pt cluster decorated Co - Pd nanoparticles enhance its mass activity by 340 times as compared to that of commercial Pt catalysts in an alkaline electrolyte of 1.0M KOH.

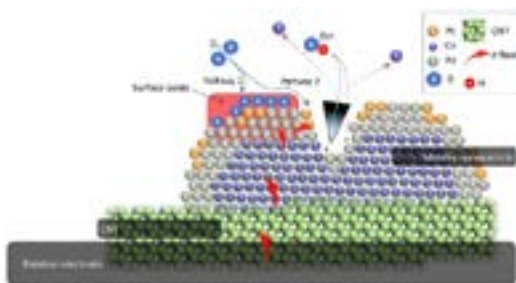


Figure 1: Schematic representation for the atomic decoration in core-shell nanoparticle and the corresponding oxygen reduction reaction pathways

Recent Publications

1. Sheng Dai, Jyh Pin Chou, Kuan Wen Wang, Yang Yang Hsu, Alice Hu, Xiaoqing Pan and Tsan Yao Chen (2019) Platinum-trimer decorated cobalt-palladium core-shell nanocatalyst with promising performance for oxygen reduction reaction. Nature Communication 10: 440.
2. Yu Zhuang, Jyh Pin Chou, Pang Yu Liu, Tsan Yao Chen, Ji Jung Kai, Alice HU and Hsin-Yi Tiffany Chen (2018) Pt₃ clusters decorated Co@Pd and Ni@Pd model core-shell catalyst design for oxygen reduction reaction: A DFT study“, Journal of Materials Chemistry A 6:23326-23335.
3. Yu Zhuang, Jyh Pin Chou, Hsin Yi Tiffany Chen, Yang Yang Hsu, Chih-Wei Hu, Alice Hu and Tsan-Yao Chen (2018) Atomic scale Pt decoration promises oxygen reduction properties of Co@Pd nanocatalysts in alkaline electrolytes for 310k redox cycles Sustainable Energy Fuels, 2:946-957.

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Biography

Tsan-Yao Chen is an Associate Professor in the Department of Engineering and System Science at National Tsing Hua University. With more than 10 years of experience in Materials Characterization and 6 years' experience in electronic device (MEMS and IC) failure analysis of multiple executives by Synchrotron Light Source Techniques (at NSRRC, Taiwan). He conducts fundamental materials development in green energy applications including solar cell, fuel cell, and CO₂ conversion, water sensing with worldwide collaboration at National rank research team in Russia, USA, Italy, Japan (SPRING-8), and UK. He is also hosting research projects from academic and industrial funds on physical chemistry researches and environment sensing technologies.

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