In-sit Probing of Surface Reactions Using Core−Shell Nanoparticle-Enhanced Raman Spectroscopy

Jian-Feng Li

Department of Chemistry, Xiamen University, Xiamen 361005, China

Email: Li@xmu.edu.cn

Abstract: Understanding the mechanism and structure-activity relationship of surface catalysis at the molecular level is the core basis for the scientific design of efficient catalysts. As a vibrational spectroscopy technique, surface-enhanced Raman scattering (SERS) paved way for sensitive detection of target analytes even down to a single molecule level. However, only roughened Ag, Au and Cu surfaces can generate strong SERS effect. To overcome the material and morphology limitations of SERS, we have developed "borrowing" strategy, shell-isolated nanoparticle-enhanced Raman spectroscopy (SHINERS), and SHINERS-satellite strategy, respectively. These methodologies enabling *in situ* tracking of surface catalysis processes on model single-crystal surfaces and practical nanocatalysts that can hardly be studied by traditional SERS. We systematically studied a series of fundamentally important reactions, such as ORR, HOR/HER, etc., as well as the interfacial water structures. Direct spectroscopic evidence of the intermediates that other traditional techniques can hardly detect was obtained. Combined with density functional theory and other *in situ* techniques, the reaction mechanisms and structure-activity relationships of these catalytic reactions were revealed at a molecular level.

References:

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Biography:

Jian-Feng Li is a full Professor of Chemistry at Xiamen University. His research interests include core-shell nanostructures, SERS, electrochemistry, and surface (photo)catalysis, etc. He has published more than 150 peer-reviewed papers in Nature, Nature Nanotechnol., Nature Mater., Nat. Energy, Nature Catal., Nature Commun., etc.