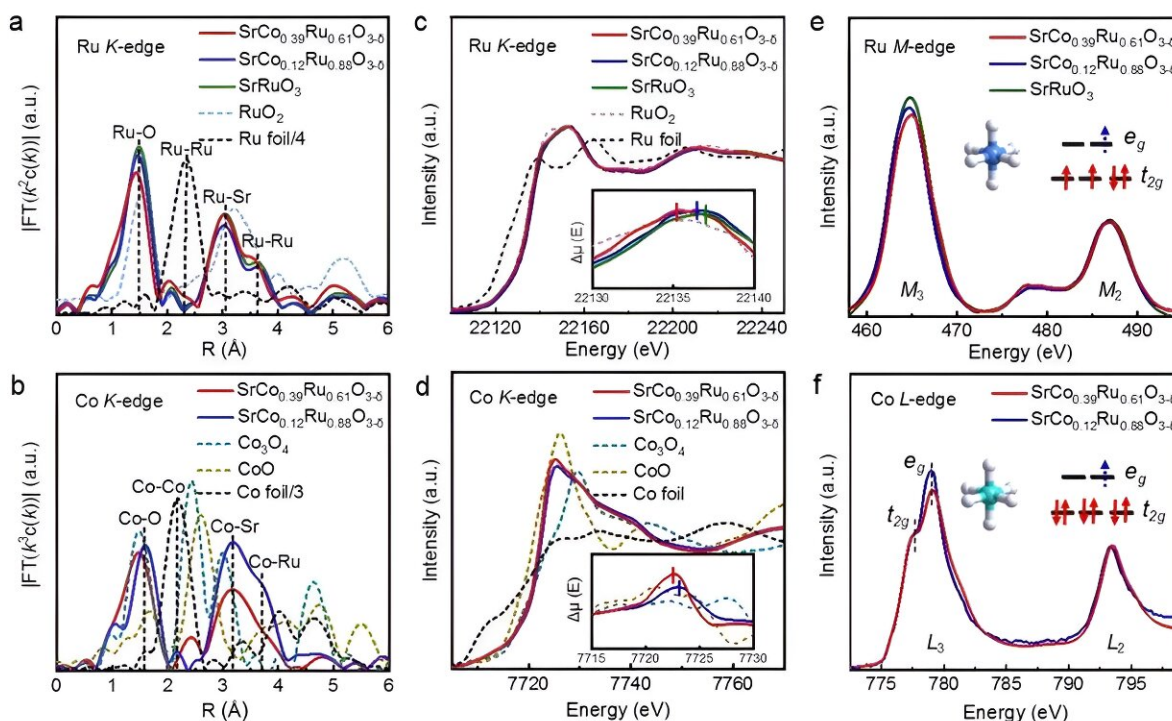


# Researchers propose doping strategy for efficient urea electrosynthesis

July 24 2024



Structural Characterization of SrCo<sub>x</sub>Ru<sub>1-x</sub>O<sub>3-δ</sub> Catalyst. (Image by YAN et al.).  
Credit: ustc

A research team led by Prof. Yan Wensheng from the University of Science and Technology of China (USTC) has proposed a doping engineering strategy that breaks the scaling relationship of intermediate binding and minimizes the kinetic barrier of C-N coupling while

realizing both high activity and high selectivity in urea electrosynthesis. The study is [published](#) in *Angewandte Chemie International Edition*.

The research team has devised an innovative catalyst featuring two independent active sites. These active sites function as reaction centers for different functional groups, thereby facilitating multiple crucial steps in the urea synthesis reaction.

The design broke the limitation of traditional catalysts, which typically possessed only a single active site. In addition, it also opened up new avenues for enhancing the catalyst's activity and selectivity.

The researchers successfully synthesized a series of  $\text{SrRuO}_3$  catalysts with varying concentrations of Co in experiments. By adjusting the Co concentration, they aimed to optimize the catalyst's performance and identify the optimal catalytic effect. Among this series of catalysts, the  $\text{SrCo}_{0.39}\text{Ru}_{0.61}\text{O}_{3-\delta}$  [catalyst](#) exhibited exceptional catalytic activity and selectivity.

X-ray absorption spectroscopy (XAS) and high angle annular dark-field scanning TEM (HAADF-STEM) image indicated that Co ions were in an occupied position, and the introduction of Co increased [oxygen vacancies](#) and the 4d electron state density of Ru. XAS and SR-FTIR revealed that Co and Ru sites were the active centers for the formation of  $^*\text{CO}$  and  $^*\text{NH}_2$  intermediates.

It was found that oxygen vacancies regulate the electronic structures of Co and Ru, weakening intermediate adsorption. While the strain of the Co-Ru dual site promoted C-N coupling and prevented the formation of by-products.

This research provides novel insights into the design of electrocatalysts for urea synthesis and the understanding of related electrocatalytic

mechanisms.

**More information:** Liyang Lv et al, Breaking the Scaling Relationship in C–N Coupling via the Doping Effects for Efficient Urea Electrosynthesis, *Angewandte Chemie International Edition* (2024). [DOI: 10.1002/anie.202401943](https://doi.org/10.1002/anie.202401943)

Provided by University of Science and Technology of China

Citation: Researchers propose doping strategy for efficient urea electrosynthesis (2024, July 24) retrieved 24 July 2024 from <https://phys.org/news/2024-07-doping-strategy-efficient-urea-electrosynthesis.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.