One step closer to coupled chemocatalytic reactions using core-shell structures

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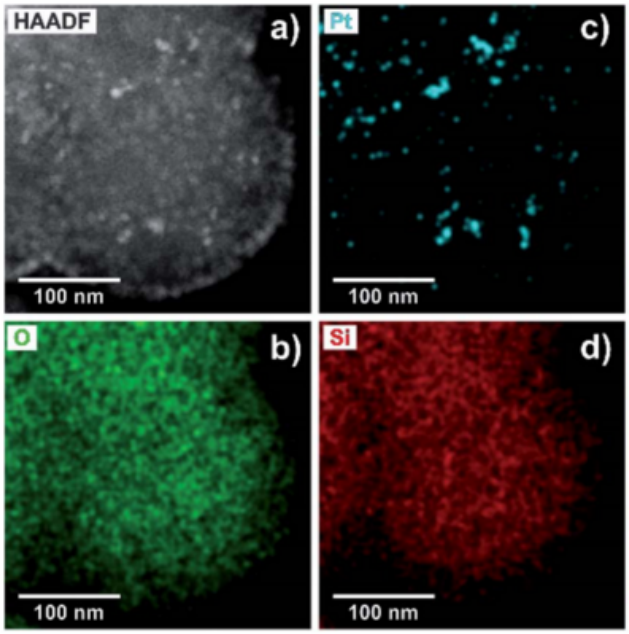

Rational design of tandem catalysts using a core–shell structure approach

Esteban Gioria, Liseth Duarte-Correa, Najmeh Bashiri, Walid Hetaba, Reinhard Schomäcker and Arne Thomas

A team of UniSysCat researchers from Technical University Berlin, Institute of Research on Catalysis and Petrochemistry, INCAPE, UNL-CONICET Santa Fe in Argentina, Fritz Haber Institute of the Max Planck Society Berlin and Max Planck Institute for Chemical Energy Conversion Mühlheim developed a new approach to synthesize multifunctional catalysts employing core-shell structures. The recent interdisciplinary study represents an important step towards the precise tuning of the distance between different active sites. This is of great importance to gain a deeper understanding of coupled catalytic reactions.

Multifunctional catalysts are much desired in chemistry: Many important chemical processes involve more than one reaction and therefore two or more different catalytic centers are required. Supported metal catalysts are widely employed in diverse chemical reactions. However, the well-controlled preparation of suitable multifunctional metal catalysts is

challenging: particularly, controlling the particle size and distribution on the support is complicated, which makes it difficult to relate the catalytic activity and selectivity to a well-defined active site. Reducing the structural complexity of multicomponent catalysts might allow better control of the synergistic effects between two active sites and thus gain a deeper understanding of reaction mechanisms.

In their communication, Gioria et al. present a facile and scalable route for the preparation of multifunctional catalysts, allowing to control the distance between two different metal nanoparticles in one material. This is exemplied by the preparation of platinum nanoparticles and cobalt nanoparticles spatially separated by a mesoporous silica layer. The shell allows the access of the reactants to the first active center located on the core, and the diffusion of the intermediary molecules to the second one at the outer shell. This methodology can be applied to the design of several multi-metallic materials, suitable for the study of diverse chemical reactions. The catalyst has been tested on the environmental and commercial relevant carbon dioxide hydrogenation reaction, indicating that a successful tandem process is achieved. This protocol can be easily extended to other metallic nanoparticle combinations as active centers for diverse chemocatalytic reactions.

The analysis and findings of Gioria et al. are found in an open-access paper in the RSC journal *Nanoscale Advances*: Esteban Gioria, Liseth Duarte-Correa, Najmeh Bashiri, Walid Hetaba, Reinhard Schomaecker and Arne Thomas, "Rational design of tandem catalysts using a core–shell structure approach", Nanoscale Adv., 2021,**3**, 3454-3459,
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