Developing pioneering ways to study catalysts

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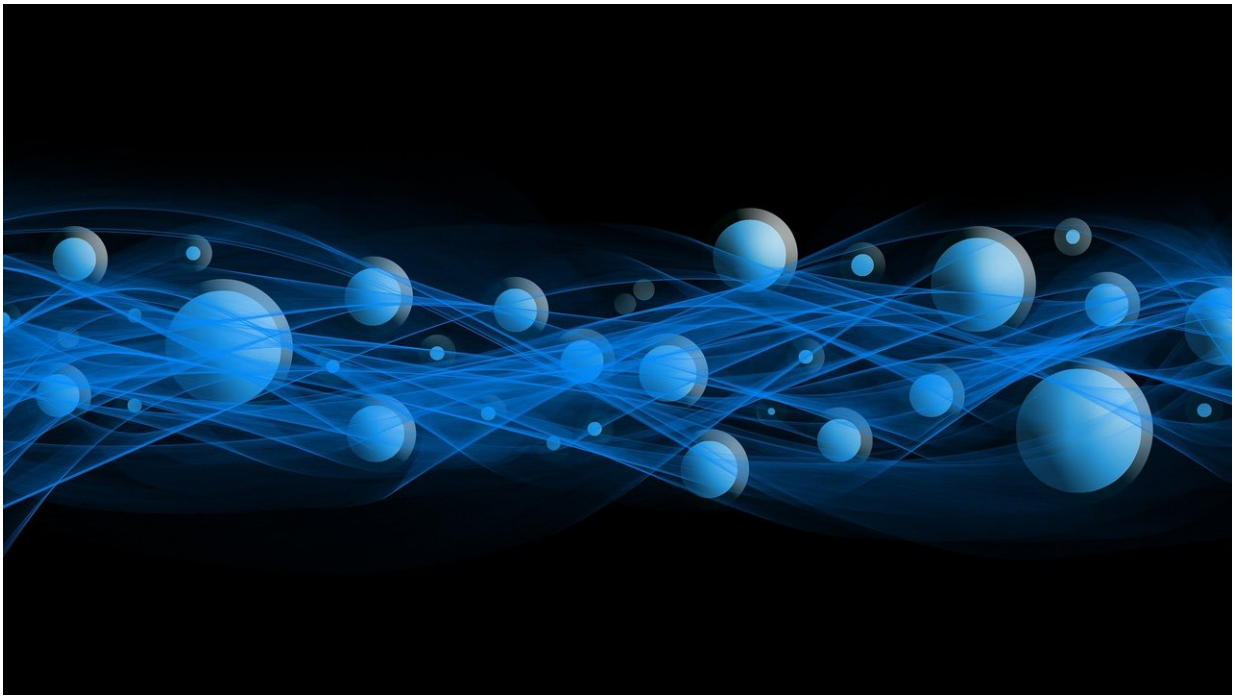

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In a pioneering application of operando spectroscopy, researchers at The University of Manchester at Harwell (UoMaH), in collaboration colleagues at Diamond Light Source, University College London, University of Sheffield, and colleagues in the Department of Chemistry at The University of Manchester, have developed a way to study heterogeneous catalysts under operating conditions.

This approach sheds light on the true nature of active species responsible for catalytic conversion and the stability of these sites under reaction conditions. This method will aid further development of catalytic materials.

Devising a new approach

The breakthrough has been realized through the development of experimental setups for interrogating solids within liquid and gas phase reactors. Under liquid phase conditions, researchers revealed the nature of isolated Pd sites supported on NiO, an excellent alcohol oxidation catalysts, and their stability, to confirm the deactivation pathway responsible for decreasing performance over the duration of the reaction.

The deployment of a microfluidic device has allowed the nucleation and growth of Pt nanoparticles, candidates that are widely used within catalysis, to be monitored, while the nature of soluble Fe species, resulting from chemical reactor corrosion during CO_2 capture, have also been studied.

Similarly, operando studies of vapor and gas phase processes have revealed the nature of Nb sites, which are active for pentadiene production from biomass, and the dynamic nature of Ni nanoparticle surfaces under CO_2 capture and subsequent conversion to CO and methane.

This insight provides the foundations for future catalyst design strategies to enable more effective nano-engineering of catalytic materials.

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