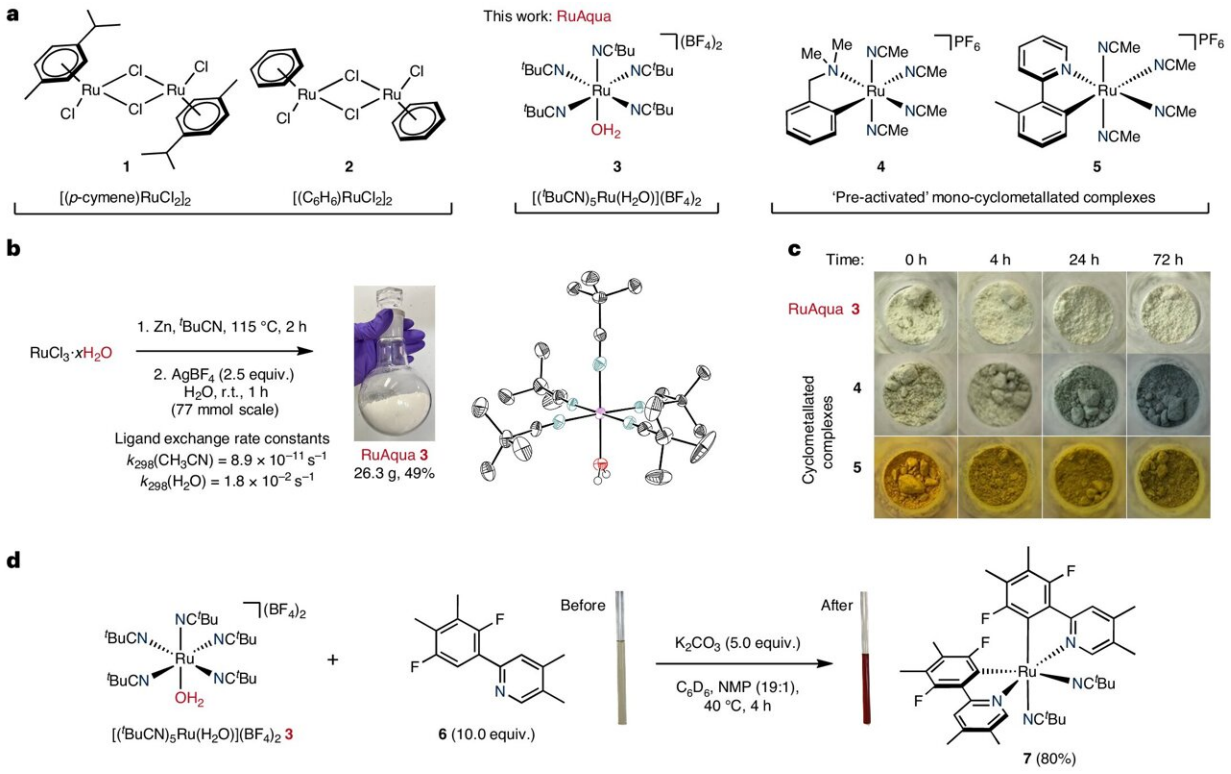
Scientists unveil ruthenium catalyst for new reaction discovery and optimization

April 8 2024, by Jessica Marsh



Design and synthesis of an air- and moisture-stable ruthenium(II) precatalyst. Credit: *Nature Chemistry* (2024). DOI: 10.1038/s41557-024-01481-5

Researchers at The University of Manchester have developed a new catalyst which has been shown to have a wide variety of uses and the potential to streamline optimization processes in industry and support

new scientific discoveries.

Catalysts, often considered the unsung heroes of chemistry, are instrumental in accelerating chemical reactions, and play a crucial role in the creation of most manufactured products. For example, the production of polyethylene, a common plastic used in various everyday items such as bottles and containers or found in cars to convert harmful gases from the engine's exhaust into less harmful substances.

Among these, ruthenium—a platinum group metal—has emerged as an important and commonly used catalyst. However, while a powerful and cost-effective material, highly reactive ruthenium catalysts have long been hindered by their sensitivity to air, posing significant challenges in their application. This means their use has so far been confined to highly trained experts with specialized equipment, limiting the full adoption of ruthenium catalysis across industries.

In new research published in the journal *Nature Chemistry*, scientists at The University of Manchester working with collaborators at global biopharmaceutical company AstraZeneca unveil a ruthenium catalyst proven to be long-term stable in air while maintaining the high reactivity necessary to facilitate transformative chemical processes.

"We are extremely excited about this discovery. Our new ruthenium catalyst boasts unparalleled reactivity, while maintaining stability in air—a feat previously thought unattainable. As well as eliminating the need for specialized equipment or handling procedures, it also enables the user to run simultaneous reactions, facilitating rapid screening and streamlining optimization procedures.

"This means procedures are quicker, more environmentally friendly and the accumulation of large amounts of waste is prevented," said Gillian McArthur, lead author and Ph.D. student at The University of

Manchester

The discovery allows for simple handling and implementation processes and has shown versatility across a wide array of chemical transformations, making it accessible for non-specialist users to exploit ruthenium catalysis. Collaborative efforts with AstraZeneca demonstrate this new catalyst's applicability to industry, particularly in developing efficient and sustainable drug discovery and manufacturing processes.

Dr. James Douglas, Director of High-Throughput Experimentation who collaborated on the project from AstraZeneca said, "Catalysis is a critical technology for AstraZeneca and the wider biopharmaceutical industry, especially as we look to develop and manufacture the next generation of medicines in a sustainable way. This new catalyst is a great addition to the toolbox and we are beginning to explore and understand its industrial applications."

The new approach has already led to the discovery of new reactions that have never been reported with ruthenium and with its enhanced versatility and accessibility, the researchers anticipate further advancements and innovations in the field.

More information: Gillian McArthur et al, An air- and moisture-stable ruthenium precatalyst for diverse reactivity, *Nature Chemistry* (2024). DOI: 10.1038/s41557-024-01481-5

Provided by University of Manchester

Citation: Scientists unveil ruthenium catalyst for new reaction discovery and optimization (2024,

April 8) retrieved 21 May 2024 from https://phys.org/news/2024-04-scientists-unveil-ruthenium-catalyst-reaction.html

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