Chemist stitches up speedier chemical reactions

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This is Warren Piers, namesake of the Piers catalyst, in his laboratory at the University of Calgary. Credit: Meghan Sired, University of Calgary

Some people have streets named after them. Warren Piers, a chemistry professor at the University of Calgary, has a catalyst penned after him.

And in a paper published today in the online edition of *Nature Chemistry*, Piers and former graduate student Edwin van der Eide reveal the inner workings of the Piers catalyst at a molecular level of detail not previously available.

"These details are critical for the development of improved catalysts," says Piers, the paper's co-author and S. Robert Blair Professor of chemistry at the University of Calgary. "It will help us and others find new applications and improved reaction conditions for these catalysts."

A chemical catalyst is a molecule that speeds up a chemical reaction without being consumed in the reaction. Enzymes are nature's catalysts, but humankind has invented catalysts that improve and are often required to drive many commercially important chemical reactions.

Catalysts are so versatile that they are used in many chemical industries, ranging from commodity chemicals, those produced on a large scale, to fine chemicals, specialty products like pharmaceuticals, for example.

Catalysts allow companies to make products more economically (lower energy costs) and more selectively (less waste). The details revealed in this paper open the door to new products and materials, creating new companies and markets. One new application involves the production of biofuel hydrocarbon products from seed oils derived from plants.

The paper explores at a level of detail not seen before the inner workings of a chemical reaction called "olefin metathesis." If knitting a wool sweater, catalysts can be thought of as the knitting needles, while the particular stitches required to fashion the wool into a pattern can be viewed as the chemical reaction.

"When we apply this to chemistry, you could say that the stitches -olefin metathesis reactions- have been around for some time. Chemists have been working for decades to figure out which needles do the work most efficiently," says Piers, whose discovery of more efficient olefin metathesis catalysts is now connected with his name.

"The results of this paper are valuable because we now know important details about a significant reaction," he explains. "The olefin metathesis reaction provides an extremely versatile method to break and reform carbon-carbon bonds in materials used in the manufacture of chemical products."

Materia Inc., a Pasadena-based chemical technology company, has the first rights to further develop and commercialize Piers' technology, which is licensed through UTI. Materia was keen to add Piers' technology to their library of catalysts to make their portfolio more versatile.

The Piers catalyst is related to the Nobel Prize-winning family of catalysts known as the Grubbs catalyst, named for their discoverer Robert Grubbs of Caltech. The Piers system has unique chemical attributes that Materia is hoping to exploit in new applications. While not yet as widely used as the Grubbs catalyst, there is strong growth potential for the Piers catalyst due to its high reactivity.

More information: Nature Chemistry - www.nature.com/nchem/index.html

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