Pacific Northwest NATIONAL LABORATORY

New Catalyst Might Expand Bio-Ethanol's Usefulness

Possible uses: fuel additives, rubber and solvents

Researchers at Pacific Northwest National Laboratory and Washington State University have potentially found a renewable path to fuel additives, rubber and solvents.

RESULTS

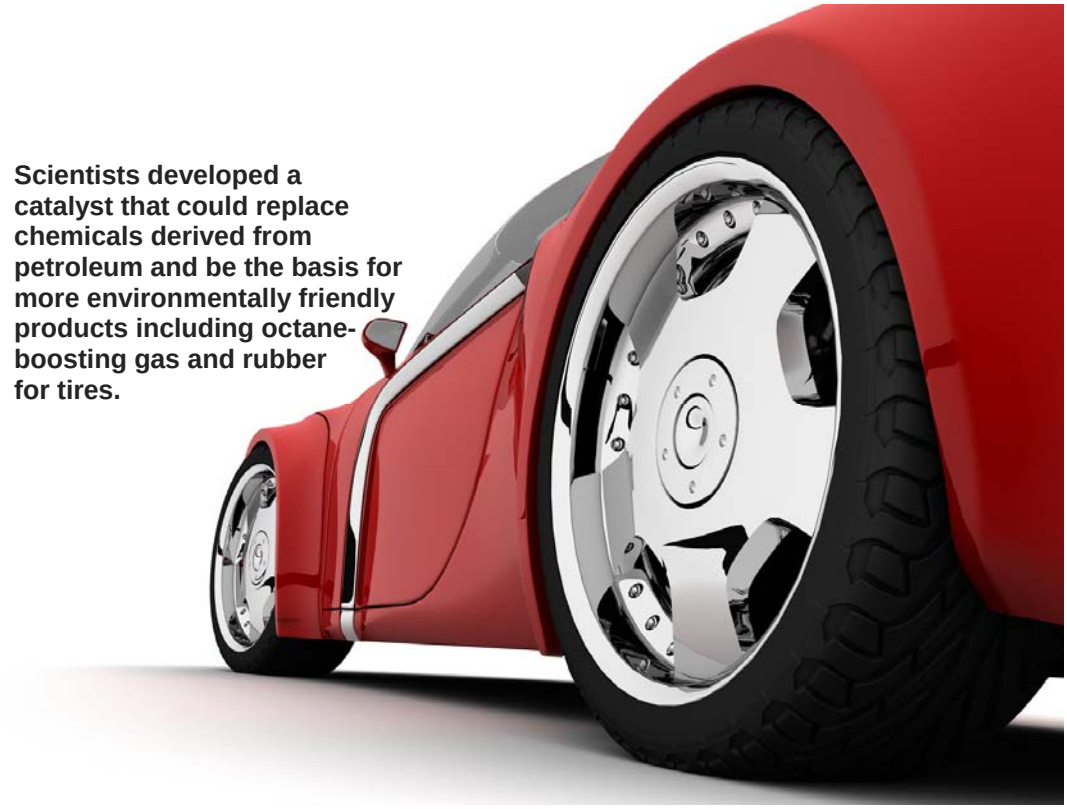
To turn bio-ethanol into chemicals that are typically made from petroleum, researchers at the Pacific Northwest National Laboratory and Washington State University have developed a new catalyst material that will convert the plant-derived alcohol into a chemical called isobutene. And the catalyst can do so in one production step, which can reduce costs. In addition, this catalyst requires the presence of water, allowing producers to use dilute and cheaper bio-ethanol rather than having to purify it first, potentially keeping costs lower and production times faster.

Reported by researchers in the Institute for Integrated Catalysis at PNNL and in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering at WSU, the findings appeared July 21, *Journal of the American Chemical Society*.

WHY IT MATTERS

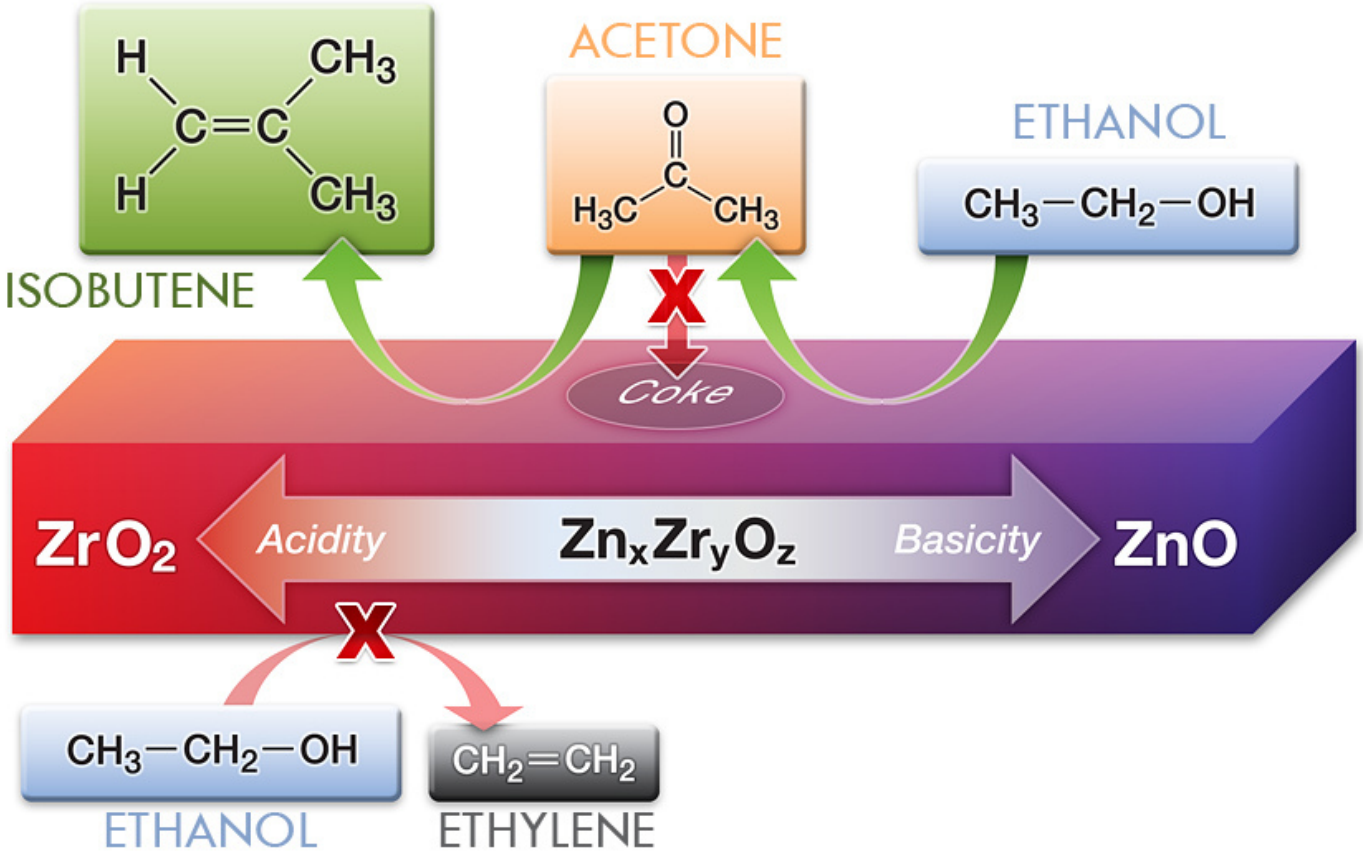
Currently, bio-ethanol's main values are as a non-polluting replacement for octane-boosting fuel additives to prevent engine knocking and as a renewable replacement for a certain percentage of gasoline. Scientists would like to use it to be the basis for more environmentally friendly products including octane-boosting gas and fuel additives, bio-based rubber for tires and a safer solvent for the chemicals industry.

"Isobutene is a versatile chemical that could expand the applications for sustainably produced bio-ethanol," said chemical engineer Dr. Yong Wang, who has a joint appointment at PNNL and WSU, and leads research efforts at both institutions.



Scientists developed a catalyst that could replace chemicals derived from petroleum and be the basis for more environmentally friendly products including octane-boosting gas and rubber for tires.

U.S. DEPARTMENT OF ENERGY



The right balance of zinc and zirconium oxides in this catalyst (purple block) converts ethanol to isobutene with low amounts of unwanted byproducts such as acetone and ethylene.

WHAT'S NEXT?

Future work will look into optimizations to further improve the yield and catalyst life. Wang and colleagues would also like to see if they can combine this isobutene catalyst with other catalysts to produce different chemicals in one-pot reactions.

ACKNOWLEDGMENTS

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REFERENCE

J Sun, K Zhu, F Gao, C Wang, J Liu, CHF Peden, and Y Wang. 2011. "Direct Conversion of Bio-ethanol to Isobutene on Nanosized $Zn_xZr_yO_z$ Mixed Oxides with Balanced Acid-Base Sites." *Journal of the American Chemical Society*,133(29):11096-11099. DOI 10.1021/ja204235v.

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