New Catalyst Reduces Wasted Carbon in Biofuel Process, Lowers Cost

NREL researchers have shown that incorporating copper-modified catalysts into the dimethyl ether-to-fuels pathway increases carbon efficiency and decreases overall production costs.

The biomass-to-liquid-fuel approach remains one of the most promising renewable fuel processes in terms of its immediate impact and compatibility with existing infrastructure. Methanol and dimethyl ether (DME) can be produced from biomass, and recent investigations have shown that certain catalysts can convert these to high-octane gasoline. However, this is a hydrogen-deficient process that produces a large amount of wasted carbon byproducts that result in catalyst deactivation, thus increasing overall costs. The bottom line: because carbon-rich biomass is one of the primary expenses of the high-octane gasoline pathway, if the process is wasting carbon, it’s wasting money.

Recently, scientists at the National Renewable Energy Laboratory (NREL) developed a catalyst formulation and structure that is capable of incorporating more hydrogen into the high-octane gasoline product, thus increasing the overall rate of reaction, decreasing wasted aromatic byproducts, and increasing carbon efficiency. The catalysts are comprised of a beta zeolite modified with copper, gallium, and other non-noble metals.

The metals provide sites for hydrogen addition and minimize side-reactions that produce unwanted byproducts—all with the goal of decreasing overall process costs. In addition, the NREL researchers have developed a secondary process that takes a portion of the gasoline-range product and efficiently converts it into a distillate-range fuel, 80% of which can be used as a jet fuel blendstock.

This improved DME-to-high-octane gasoline process operates under relatively mild conditions, thus offering the benefit of reduced capital and operating costs for the reactor compared to previously developed technologies.

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