

High Temperature Materials Laboratory User Program

Catalyst Characterization

Background

Meeting the 2007 diesel emission requirements may require the integration of exhaust aftertreatment with the diesel engine control systems. Commercial, off-the-shelf technologies are not available to meet the new standards. Consequently, Cummins, Inc., is working to understand the basic science necessary to develop these systems. Oak Ridge National Laboratory (ORNL) is assisting with the materials characterization effort.

The Technology

Alkali and alkaline earth metal oxides are major storage components in catalyst systems incorporating adsorbers for oxides of nitrogen (NO_x). These components adsorb NO_x species under lean conditions; under rich conditions, the NO_x is released and converted to nitrogen over a precious-metal catalyst.

Unfortunately, oxides of sulfur can also be stored on the sites, poisoning the adsorber catalyst. Catalyst poisoning is a major

problem that must be resolved before NO_x adsorber emission reduction technologies can become commercially viable.

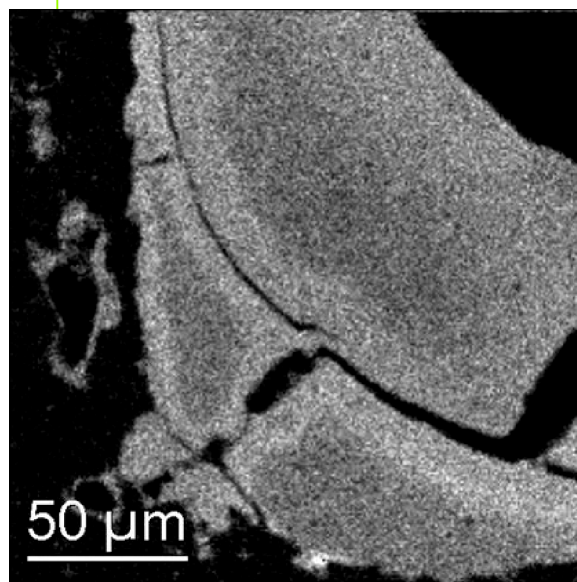
Laboratory-based and engine-tested catalytically active materials supplied by Cummins are being characterized using X-ray diffraction, Raman spectroscopy, and electron microscopy. These materials come from all stages of the catalyst's lifecycle: raw materials, as-calcined, sulfated, regenerated, and so forth. These studies are providing insight and direction for solving the poisoning problem.

Future Direction

Future efforts include in situ characterizations of catalysts in simulated engine environments to identify surface-adsorbing species during nitration and sulfation.



Less dependence on foreign oil, and eventual transition to an emissions-free, petroleum-free vehicle



Platinum X-ray map from a sample loaded with platinum after 500 desulfation hours. Note the higher concentration of platinum at free surfaces in the washcoat, which remained essentially constant with aging treatments.

Benefits

ORNL and Cummins scientists and engineers are collaborating to understand and solve this important scientific, economic, and environmental problem.

Where Can I Find More Information?

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Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



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