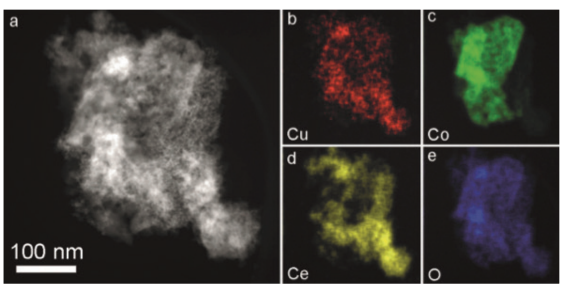
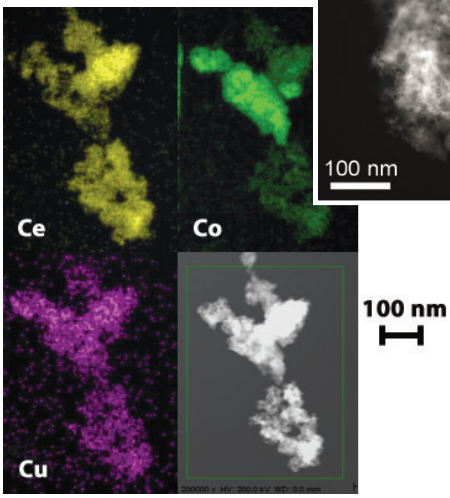
Meeting More Restrictive Emission Standards: A New, Low-Temperature Oxidation Catalyst

The current standard for controlling pollutants in automotive exhaust incorporates Platinum Group Metal (PGM) catalysts. These catalysts are unfortunately very expensive, and they struggle with oxidation of carbon monoxide (CO) and hydrocarbon pollutants at lower temperatures. As engine fuel efficiency improves, less energy is wasted as heat in the exhaust resulting in lower exhaust temperatures, and catalysts have more difficulty achieving the necessary efficiency for pollution control. Therefore, engines require more advanced catalysts that are capable of operating at lower temperatures to meet newer, and stricter, emission regulations. Researchers at ORNL have developed a low-temperature oxidation catalyst that can meet these new industry needs. ORNL's catalyst is composed of cerium, cobalt, and copper, in addition to traditional components of PGM catalysts. This catalyst offers improved low-temperature oxidation at a lower cost than traditional PGM catalysts. ORNL's catalyst offers performance advantages for engines today as well as for new fuel-efficient engine technologies of the future, including hybrid vehicles.

This project was accepted into TIP with the goals of scaling up cerium, cobalt, and copper (CCC) material to >1kg batch size, coating CCC material and PGMs on a cordierite substrate monolith for engine study, and comparing the full-scale CCC catalyst with state-of-the-art commercial catalysts. Since the project began, Dr. Parks' team has developed a procedure for making large batches of active catalysts with even better reactivity than predicted, and they have transferred the technique to a company to produce 10 kg batches of active catalyst powder. Once the full-scale catalyst is produced, engine studies will be conducted at ORNL's National Transportation Research Center engine dynamometer laboratories.

The biggest advantage of this technology is that it can oxidize pollutants at lower temperatures than ever before with lower overall cost. In addition to automotive and trucking applications, the catalyst offers similar advantages for power generation from stationary sources such as gas turbines.





Publications

- Andrew J. Binder, Todd J. Toops, Raymond R. Unocic, James E. Parks II, Sheng Dai, "Low Temperature CO Oxidation over Ternary Oxide with High Resistance to Hydrocarbon Inhibition", *Angewandte Chemie International Edition.*

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Dr. Jim Parks leads the Emissions and Catalysis Research Group at the National Transportation Research Center at Oak Ridge National Laboratory. He received his B.S. in physics from North Carolina State University in 1989 and his PhD in physics from the University of Tennessee in 1995. Prior to joining Oak Ridge National Laboratory, Dr. Parks worked in the private sector at EmeraChem LLC. Dr. Parks also has numerous publications in peer-reviewed journals. His current research interests are emission control for lean burn and advanced combustion engines as well as catalysis for biomass-to-fuel processes.

Technology

Low Temperature Oxidation Catalyst
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