



## NO<sub>x</sub> Sensing and Control for Heavy Vehicles

### Background

Sensors that can quantitatively measure NO<sub>x</sub> emissions in real time are potentially an enabling technology for the clean diesel engines of the future. Closed loop engine control systems that monitor emissions and continuously adjust engine and emission-control parameters such as fuel injection behavior, valve timing, EGR and air-handling control are envisioned for near-zero emission heavy vehicles for the future. However, the closed loop control systems are dependent upon rapid, reliable and accurate sensors.

### The Technology

Oak Ridge National Laboratory (ORNL) and Ford Motor Company have entered into a cooperative research and development agreement (CRADA) to develop a NO<sub>x</sub> sensor for heavy vehicle applications. This project is focused on evaluating materials for use in NO<sub>x</sub> sensors. In particular, ORNL is studying the effectiveness of various oxides as sensing electrodes in potentiometric devices. The evaluation of these materials considers sensitivity, selective, stability and response time to the species of interest, along with materials cost and sensor design issues.

### Benefits

- NO<sub>x</sub> sensors can be used for closed-loop control of emission control technologies and optimum engine operation.
- Benchmark experiments have identified major technology barriers to heavy-vehicle NO<sub>x</sub> sensors.
- Materials development efforts have reduced processing temperatures, which allows use of more selective catalytic electrodes.

### Equipment and Expertise

- Test stand with fully automated gas-mixing unit, in-line measurement of NO and NO<sub>2</sub> concentrations up to 1000°C.
- IR test stand for rapid screening of catalytic materials.
- Thermal-analytical equipment for independent assessment of materials interactions with various gas species.
- Production of solid electrolyte substrates for prototype devices.
- Class 100 clean room for screen printing of electrode assemblies and lamination of sensor bodies.



*Laboratory apparatus for benchmark tests of prototype NO<sub>x</sub> sensors.*

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