

## State-of-the-Art Instrumentation

### Analytical Instrumentation

#### Gas Phase Species

- Two Nicolet REGA 7000 Systems
  - Nexus 670 ( $0.125\text{ cm}^{-1}$  resolution)
  - Nicolet Magna 560 ( $0.5\text{ cm}^{-1}$  resolution)
  - Heated 10m path length cell ( $150^{\circ}\text{C}$ )

#### Innova Model 1312 Photoacoustic Analyzer

- Filters for methanol, ethanol,  $\text{N}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{CO}_2$ ,  $\text{H}_2\text{O}$

#### Ametek 920 Series UV for Sulfur Species in Exhaust

#### API Pulsed-Fluorescence Instrument to dilute exhaust $\text{SO}_2$ measurement

#### Cambustion fast $\text{NO}$ , fast FID for high speed $\text{NO}$ and HCs

#### Spacially Resolved Capillary Inlet Mass Spectrometer (Spaci-MS)

- Used to examine axial and radial distributions of species inside catalysts and manifolds on operating engines. Example in SAE 2000-01-2952, 2002-01-2882.

#### Gas sensor research apparatus—a fully characterized flow tube and solenoid valve system for the understanding response time for gas sensors

- Heat and moisture available

#### Particulate Characterization

#### TSI Model 3936 Scanning Mobility Particle Sizer

- Large and small DMAs; 2nm-1um range

#### 2 R&P model 1105 Tapered Element Oscillating Microbalance (TEOM)

#### 2 AVL Smoke Meter

#### MSD micro-Orifice Uniform Deposit Impacter (MOUDI) for mass-based size distribution

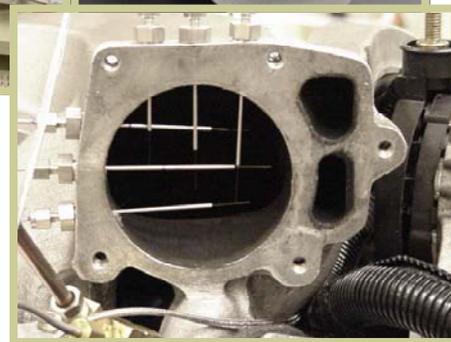
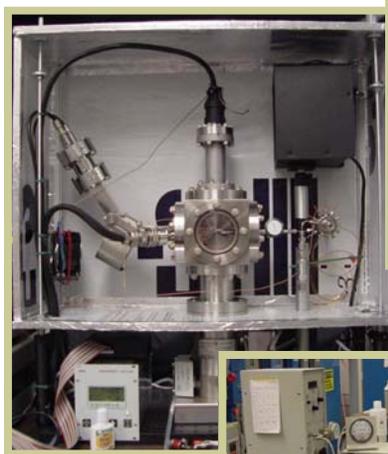
#### Other Instrumentation

#### Cormon Ceion Corrosion Probe

- For measuring corrosion in the EGR system. Has been correlated to corrosion coupons.

#### High Speed Digital Storage Oscilloscopes

- Tektronix model TDS75 1 GHz
- Tektronix Model TDS7704 25 GHz digital phosphor oscilloscope



### Current Projects:

The availability of specialized instrumentation sets the FEERC apart from other research laboratories. Many of the specialized instruments are used routinely to supplement measurements required during research. For instance, the particulate characterization instruments (TEOM, SMPS) capacity were combined to compare particulate formation for two different  $\text{NO}_x$  adsorber strategies. In another case, the combustion Fast  $\text{NO}_x$  instrument was used to characterize a  $\text{NO}_x$  sensor test package. Used extensively to characterize species in their operating catalysts, Spaci-MS has also been used to map EGR distribution in the intake manifold of a light-duty engine. FTIR has proven invaluable to understanding the performance of light-duty SCR systems. Nitrous oxide selectivity and byproduct formation are often very dependent on space velocity and temperature.