

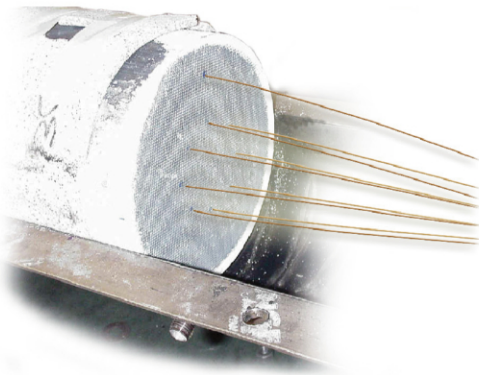
# Transportation Research Programs

**T**he Oak Ridge National Laboratory Transportation Research Program comprises research and development primarily for the Department of Energy FreedomCAR and Vehicle Technologies Program. Major research areas are fuels and engines, materials, power electronics and electric machines, and analysis.



## Fuels and Engines

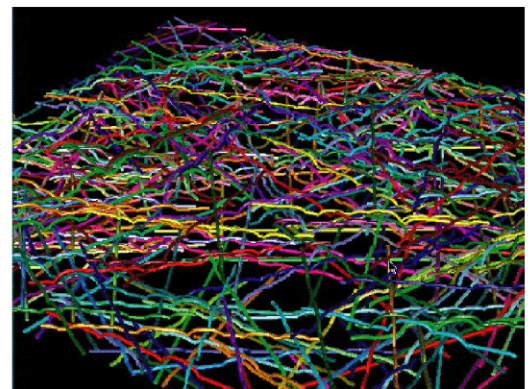
The Fuels, Engines, and Emissions Research Center specializes in advancing the energy efficiency of vehicle engines, and the detailed characterization of internal combustion engine emissions. The Center also performs research on the effects of fuel properties on advanced, high-efficiency combustion regimes, to assist in the identification of alternative and replacement fuels for use during the transition to a hydrogen economy. The Center's comprehensive capabilities range from bench-top experimental equipment to vehicle chassis dynamometers, and several special diagnostic and measurement tools -- including many developed by Center staff -- that aid in development and evaluation of engine and exhaust aftertreatment technologies to increase efficiency while controlling emissions.



*Minimally invasive SPACI-MS (spatially resolved capillary inlet mass spectrometry) uses capillary tubes to sample emissions inside catalyst monolith channels, engine intake ports, and so forth.*

## Materials

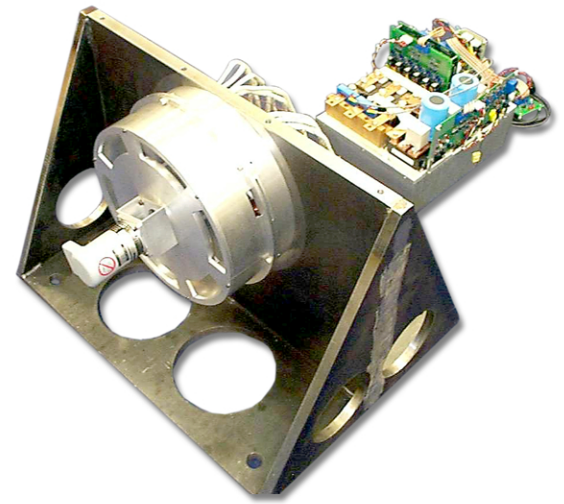
The transportation materials research portfolio includes basic research; long-range applied research; and technology development in metals, ceramics, polymers, carbon, and composites. ORNL brings a multidisciplinary approach to materials research that includes modeling of complex phenomena, first-principles theory, materials synthesis and processing, structural characterization, physical and mechanical property determination, and development of prototypical manufacturing processes.



*Output from a computer model illustrating the carbon fiber deposition process in composite manufacturing. Both 2-D and 3-D models have been developed to address fundamental manufacturing issues.*

# Power Electronics and Electric Machines

The Power Electronics and Electric Machinery Research Center is recognized worldwide for its expertise in developing and prototyping advanced power electronics and electric machines. The Center develops and evaluates power converter topologies; thermal management schemes; packaging technologies that minimize weight, footprint, and electromagnetic interference; control techniques for motor drives; system energy management; ultra-high-speed drives; and flywheel energy storage applications. This expertise is applied in electric and hybrid vehicles, turbochargers, fuel cells, power transmission and distribution systems, and distributed energy systems.



# Transportation Data and Analysis

ORNL conducts modeling and analysis to support policies, plans, and research and development programs to reduce U.S. dependence on petroleum and to mitigate greenhouse gas emissions from the transportation sector. The research has made significant contributions to national fuel economy policy, and it has provided insight into the economic and environmental effects of transition from conventional petroleum-based fuels to alternative fuels ranging from reformulated gasoline and diesel fuel to hydrogen.

*In a collaborative effort between ORNL and Rockwell Scientific, an all-silicon carbide power module is being developed and built. Silicon carbide meets the performance requirements for future transportation applications, but research and development is needed to resolve issues related to cost and processing.*



*The Transitional Alternative Fuels and Vehicles model integrates consumer and producer behavior in a non-linear dynamic economic model.*

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