

# ***Grants Awarded***

**From 3/1/07 To 3/31/07**

***Principal Investigator:*** Dean Richey, Curriculum and Instruction

***Supporting Professionals:*** Filomena Palmer, Peggy Brittingham, Rhonda Hall, Lisa Davis, Kathy Long,  
Stacy Macon, Sherry Roberts, Kim Correll, Susan O'Connor, Kelly Hodge,  
Martha Howard, Michele Priddy, Denette Way, Rhonda Bartlett, Cindy Mayer

***Project Title:*** Tennessee's Early Intervention System 2006-07

***Activation Amount:*** \$150,000.00

***Agency:*** Tennessee Department of Education

***Principal Investigator:*** Hayden Mattingly, Biology

***Project Title:*** Science Advisory Committee Coordination for the Northern Cumberland Plateau  
Habitat Conservation Plan

***Activation Amount:*** \$6,000.00

***Agency:*** The Nature Conservancy

The researchers are conducting a study to determine the impacts of human land use activities on blackside  
dace reproductive ecology.

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**From 3/1/07 To 3/31/07**

***Principal Investigator:*** Ying Zhang, Mechanical Engineering

***Project Title:*** A Novel Low-Temperature Diffusion Aluminide Coating for Ultrasupercritical Coal-Fired Boiler Applications

***Activation Amount:*** \$78,327.00

***Agency:*** U. S. Department of Energy

An ultrasupercritical (USC) boiler with higher steam temperature and pressure than current boilers is expected to increase the thermal efficiency of the coal-fired plant and also decrease emissions of air pollutants. Ferritic/martensitic steels have been developed with higher creep strength for the key components in coal-fired USC plants. However, they typically suffer excessive steam-side oxidation, which contributes to one of the main degradation mechanisms along with fire-side corrosion in coal-fired boilers. As steam temperatures further increase in USC boilers, oxidation of the tube internals will become an increasing concern. One approach to overcoming oxidation limitations is through the use of coatings, which are on the internal surface of tubes. As compared to overlay coatings produced by thermal spray or other techniques, diffusion coating technology offers two major advantages: (i) It constitutes the only viable way to add extra alloy protection to the inside surface of steam containing tubing surface without reverting to bimetallic tubing options; (ii) It is particularly attractive because the coating is incorporated into the metal substrate, thereby avoiding spalling or other loss of the coating protection. Therefore, the main objective of this proposal is to develop a low-temperature (<700 °C) diffusion aluminide coating with reduced brittleness via pack cementation for protection of USC boiler internal tubing, to compare the low-temperature aluminide coatings with model chemical vapor deposition (CVD) coatings in terms of oxidation resistance to water-vapor attack and coating microstructural evolution during thermal exposure, and to investigate the effect of the low-temperature aluminide coatings on mechanical properties of substrate ferritic/martensitic alloys, where very little knowledge exists. The outcome of this research will not only offer improvement of steam-side oxidation resistance of USC boiler tubing components, but also provide a better understanding of the role of aluminide coatings on alloy mechanical properties. Also, through integration of fundamental, technological, and applicatory aspects, a low-cost alumina-forming coating will be developed for higher-temperature steam conditions. In addition, this research has direct relevance to industry and to the transfer of research to industrial practice.

# *Grants Awarded*

**From 3/1/07 To 3/31/07**

***Principal Investigator:*** Kenneth Morgan, Biology/Tom Roberts, Biology

***Project Title:*** Hydrogeomorphic Classification and Assessment of Slope Wetlands on the Tennessee Highland Rim

***Activation Amount:*** \$61,604.00

***Agency:*** Tennessee Department of Environment and Conservation

The project team will review scientific literature to identify functions performed by slope wetlands in the project area and the physical, chemical, or biological characteristics of the wetlands responsible for the performance of the functions. They will also develop protocols for identifying and classifying wetlands located in topographically low-lying areas within the reference domain; conduct field surveys to select sites representing the entire range of conditions that exist within the reference range; sample selected wetlands using standard methods; produce a guidebook; and develop a rapid wetland assessment technique for both slope and depression wetlands based on collected data.

***Principal Investigator:*** Kenneth Morgan, Biology/Tom Roberts, Biology

***Project Title:*** Hydrogeomorphic Classification and Assessment of Slope Wetlands on the Tennessee Highland Rim

***Activation Amount:*** \$20,522.00

***Agency:*** Tennessee Department of Environment and Conservation

The project team will review scientific literature to identify functions performed by slope wetlands in the project area and the physical, chemical, or biological characteristics of the wetlands responsible for the performance of the functions. They will also develop protocols for identifying and classifying wetlands located in topographically low-lying areas within the reference domain; conduct field surveys to select sites representing the entire range of conditions that exist within the reference range; sample selected wetlands using standard methods; produce a guidebook; and develop a rapid wetland assessment technique for both slope and depression wetlands based on collected data.

# *Grants Awarded*

**From 3/1/07 To 3/31/07**

***Principal Investigator:*** Yvette Clark, Water Center

***Supporting Professionals:*** Amy Knox, Water Center

***Project Title:*** Local Planning Assistance Office-Geographic Information System Improvement Proposal

***Activation Amount:*** \$83,674.00

***Agency:*** Tennessee Department of Economic and Community Development

The project will result in the development of a centralized spatial data management system, and through the use of ArcSDE and ArcIMS technologies, authorized users within the Local Planning Offices will be ensured open access to the data, thus, making it available to a wider range of users. The developed system will incorporate the appropriate hardware and software protocols to create a data-sharing, storage, and security system with redundant backup capabilities to maintain and protect valuable data for authorized users. Wireless communication solutions will be researched and evaluated for use by emergency communications personnel to establish communication and digital information access as an integral part of an emergency preparedness system. The project will also evaluate and create GIS applications for Business Development to enhance the state's existing and future GIS data, which are valuable resources used for information delivery to the Local Planning staff.

***Principal Investigator:*** Holly Stretz, Chemical Engineering

***Project Title:*** Determination of Montmorillonite Nanocomposite Aggregation Rates Using Real Time X-Ray Diffraction Techniques at High Temperatures

***Activation Amount:*** \$66,498.00

***Agency:*** U. S. Department of Commerce

Polymer nanocomposites are gaining market share at an exponential pace, with recent estimates in the transportation market alone of 345 million pounds per year. Their competitive advantage for molded parts, fibers and barrier sheet products often arises from a unique balance of properties, including excellent fire retardance. Only 5 weight percent of a nanoparticle clay in some polymers can reduce the composite heat release rate up to 70%. Montmorillonite clay nanoparticles are characterized by a disk-like shape, high stiffness compared to steel or fiberglass, and the temperature resistance of a ceramic. When well dispersed, they are thought to contribute to the fire performance of the composite by either interfering with the rate at which gases of degraded polymer escape from the char and become fuel, and/or by forming a char barrier which insulates underlying layers of composite from high temperatures. In the current study our objective is to measure the rate at which these particles aggregate in the polymer at conditions simulating that of a building fire. Factors affecting that aggregation rate should include the thermal stability and compatibility of polymer and surfactant coating on the clay particle. High temperature x-ray diffraction equipment, available through user agreements at Oak Ridge National Lab, is an important tool in obtaining aggregation rates real-time, while the polymer is under the conditions of a simulated burn. We will also characterize the charred materials on the nanoscale using electron microscopic techniques and image analysis. Knowing the kinetics of aggregation and knowing how physical factors affect the kinetics will help the research community build models for predicting the fire performance of the novel nanocomposite materials increasingly used in homes for such applications as cable wire and foam cushions.