

# NANOSCALE REINFORCED, POLYMER DERIVED CERAMIC MATRIX COATINGS

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## *I. Objectives*

The goal of this project is to explore and develop a novel class of nanoscale reinforced ceramic coatings for high temperature (600-1000 °C) corrosion protection of metallic components in a coal-fired environment. It is focused on developing coatings that are easy to process and low cost. The approach is to use high-yield preceramic polymers loaded with nano-size fillers. The complex interplay of the particles in the polymer, their role in controlling shrinkage and phase evolution during thermal treatment, resulting densification and microstructural evolution, mechanical properties and effectiveness as corrosion protection coatings will be investigated.

## *II. Accomplishments*

A graduate student has been recruited to work on the project. Mr. Bob Wang will work on this project as a part of his Ph.D. dissertation. He started working on this project in December 2005. The main focus of the research so far has been to conduct a comprehensive literature survey of polymer-derived ceramics and also of corrosion protection coatings in coal fired environments. The literature survey has been completed and based on this two polymeric systems and a variety of potential fillers have been identified. The student has received safety training and instructions in the use of equipment for this research. The materials are being acquired and we have conducted preliminary studies on the processing of coatings using one of these polymers. The dip coater needed for processing studies is being modified.

### ***III. Future Work***

The specific future tasks for accomplishing the objectives of this project are:

**Task 1:** Selection of material systems

**Subtask 1.1:** Optimization of Polymer/nanoparticle compositions

**Subtask 1.2:** Densification and microstructure development during pyrolysis

**Subtask 1.3:** Evaluation of corrosion properties

**Task 2:** Processing of coatings including optimization of slurry rheology

**Subtask 2.1:** Development of coating procedures including slurry rheology optimization

**Subtask 2.2:** Densification and microstructure development of the coatings (multiple coatings if needed)

**Task 3:** Characterization of coatings (mechanical and environmental)

**Subtask 3.1:** mechanical property evaluation: hardness, toughness and interfacial properties (adhesion)

**Subtask 3.2:** Environmental characterization: corrosion and oxidation in simulated coal-fired environment

In the near future, work will be done on Tasks 1 and 2 in parallel.

### ***IV. Publications etc.***

None during this period

### ***V. Student Supported Under this Grant***

Mr. Bob Wang is a first year Ph.D. student in the Department of Materials Science and Engineering at the University of Washington. He is being supported on this project since December 15, 2005. He will work on this project for its entire duration as a part of his Ph.D. dissertation.