extremEmat

NETL-Led National Laboratory Consortium to Accelerate the Development of Extreme Environment Materials

**Objective**
Develop the next generation of toolsets needed to accelerate the development of materials to improve the existing fleet and enable next generation fossil energy systems.

**Consortium Approach**
- Integrate the extensive computational materials modeling, data analytics, manufacturing, testing, and materials characterization capabilities resident within the National Laboratory complex in order to develop and demonstrate a framework to accelerate materials development.

**Project Specific Objectives**
- Create the next generation of cross-cutting computational and experimental toolsets focused on accelerating discovery and scale-up for reliably manufacturing materials at scale.
- Demonstrate application of toolset by developing a new alloy with either 50°F or 25% increase in strength.

**Accomplishments**

**Extreme Environment Roadmap Developed**
NETL completed the Extreme Environment Materials (EEM) Technology Roadmap for Fossil Energy Application. The Consortium began to address research needs identified in the EEM Roadmap in the last quarter of 2017.

**Importance**
Affordable and durable materials are a key enabling technology that cross-cuts fossil energy platforms and systems.

**Reducing the Materials Design Cycle**
- Physics-based modeling tools
- High-throughput screening tools
- Data Analytics
- Materials Solution
  - Component Design & Performance Requirements
  - Processing Microstructure Modeling Tools
  - Solid-State Microstructure Evolution Modeling Tools
  - Mechanical Property Modeling Tool

- Achieve Cost/Time Reduction
- Predict Materials Service Performance & Manage Part Life
- Goal: 2x to 4x Reduction in Time to Insert a New Material

**FY 2017 Budget – All Partners**
$764,000

**Contact Information**
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**Extreme Environment Materials**
- State-of-the-Art Technology
- DOE Advanced R&D
- DOE Super-Critical Water (SCW) Technology
- DOE Advanced NETL

**DOE-FE/NETL Vision**
- "Born Qualified" EEMs
  - Advanced USC Steam
  - Advanced Turbine Inlet Temp
  - Supercritical CO2 Technology
  - Ceramic & Refractory Alloys
- Advanced USC Steam
- Ni Based Superalloys
- Advanced Turbine Inlet Temp

**Innovative Energy Concepts**
- Chemical Looping
- Direct Power
- Supercritical CO2
- Plasma Conversion

**Abbreviations**
- EEM: Extreme Environment Materials
- DOE: Department of Energy
- Ni: Nickel
- USC: Ultra-Supercritical
- NETL: National Energy Technology Laboratory
- SCW: Super-Critical Water
- DOE-FE: DOE Fossil Energy
- Advanced: Advanced Technology