TITLE: **Developing Supersonic Impactor and Aerodynamic Lens for Separation and Handling of Nano-Sized particles**

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GRANT NO.: DE-FG26-06NT42684

PERIOD OF PERFORMANCE: January 1, 2006 to April 10, 2007 **DATE:** April 2007

ABSTRACT

OBJECTIVES

The general objective of this project is to provide the needed fundamental understanding of supersonic/hypersonic impactors as well as aerodynamic lenses for nano-particle separation and focusing. The specific objectives are:

The specific objectives are:

- To develop a design for supersonic/hypersonic impactor for nano-particle separation.
- Develop a design for aerodynamic lenses for generating focused beams of nano-particles.
- Perform a series of computational fluid dynamic (CFD) simulations of supersonic/hypersonic impactor and aerodynamic lenses for performance analysis and design optimization.
- Develop a scientific knowledge basis for supersonic/hypersonic impactors and for aerodynamic lenses.

ACCOMPLISHMENTS TO DATE

Progress was made in developing a computational model for supersonic flows of compressible gases in an aerodynamic lens with several lenses. Airflow conditions were analyzed and contour plots for variation of Mach number, velocity magnitude and pressure field in the lens were evaluated. Progress was also made in evaluating nano and micro-particle trajectories in the lens.

SIGNIFICANCE TO FOSSIL ENERGY PROGRAM

Developing effective supersonic/hypersonic impactors for nano-particle separation is of considerable interest for production of efficient catalysts for co-production of synthetic fuel and electric power in connection the FutureGen clean coal energy initiative. Also developing aerodynamic lenses for generating focused beams of nano-particles are critical to characterization of these materials.

FUTURE WORK

The plan for the deliverables for the project are:

- Develop a design for an effective supersonic/hypersonic impactor for nano-particle separation.
- Develop a design for an efficient aerodynamic lens nano-particle focusing.
- Computer simulation for various operation conditions of supersonic/hypersonic impactor for nano-particle separation.
- Computer simulation for various operation conditions of aerodynamic lens for nano-particle focusing.

ARTICLES, PRESENTATIONS AND STUDENT SUPPORT

Journals Articles (peer reviewed)

Abouali, O. and Ahmadi, G., A Model for Supersonic and Hypersonic Impactor, J. Nanoparticle Research, Vol. 7, pp. 75-94 (2005).

Conference Presentations

R.S. Chavali, and G. Ahmadi, "Particle Focusing At Atmospheric Pressures," 24th Annual Conference of the American Association for Aerosol Research, AAAR 2005, Austin, TX, October 17-21, 2005.

R.S. Chavali, G. Ahmadi, and S. Dhaniyala, "Particle Focusing Using Aerodynamic Lens with Slits," 24th Annual Conference of the American Association for Aerosol Research, AAAR 2005, Austin, TX, October 17-21, 2005.

G. Ahmadi, "Supersonic Impactor and Aerodynamic Lens for Nanoparticle Separation," Center for Advanced Material Processing (CAMP) Symposium on Materials Synthesis and Processing, Albany, NY, April 7, 2006.

G. Ahmadi, "Supersonic Impactor and Aerodynamic Lens for Nanoparticle Separation and Computational Modeling Capabilities for Material Processing," Annual Technical Meeting of the Center for Advanced Material Processing (CAMP), Canandaigua, NY,

May 17-19, 2006.

A. Zare, O. Abouali and G. Ahmadi, “A Numerical Model for Brownian Motions of Nano-Particles in Supersonic and Hypersonic Impactors,” FEDSM2006-98308, ASME 2nd Joint U.S. - European Fluids Engineering Summer Meeting, Miami, FL, July 17-20, 2006.

Students

- R.S. Chavali, (MS) student, Mech. & Aero. Engineering, Clarkson University