

AFRL DAGSI Research Topic

1. **Research Title:** Molecular modeling of nano-scale heat transfer
2. **Individual Sponsor:**

Dr. Soumya S. Patnaik, AFRL/RQQM
Bldg. 18
1950 Fifth Street
WPAFB, OH 45433-7333
Soumya.Patnaik.1@us.af.mil

3. **Academic Area/Field and Education Level**
Materials/Chemical/Mechanical Engineering / Computational fluid dynamics, Computational materials science, Heat Transfer, Thermal Sciences (MS or Ph.D.)
4. **Objectives:** Phase change based heat transfer has been identified to be one of the most efficient heat transfer mechanisms and therefore of great interest in the thermal management of airborne systems, micro-electronics, and many more. The heat transfer provided by phase change can be further augmented by nano-modification. In order to exploit the added benefits provided to cooling technologies by combining these two very intensive but diverse areas, the underlying physics of heat transfer and the effect of molecular scale phenomenon on the macroscopic heat transfer behavior have to be better understood. Molecular modeling of nano-scale heat transfer can help with providing such an insight. The objective of the present effort is to develop molecular level understanding that leads to the enhancement of nano-scale heat transfer.
5. **Description:** Research projects of interest are molecular modeling and simulation studies that address heat transfer problems in the areas of: phase change heat transfer; effect of surfactants on heat and mass transfer through solid/liquid and liquid/vapor interfaces, surface tension, wetting phenomenon, solid-liquid-vapor interfaces; homogeneous and heterogeneous nucleation; and the effect of surface treatment on heat transfer. Modeling approaches that link molecular simulations with macroscale approaches are also of interest. The DAGSI project will complement active research in the development of multiscale methods for phase change heat transfer and fluid flow being carried out at AFRL. DAGSI researchers will collaborate with researchers at AFRL to develop high fidelity heat transfer models with predictive capabilities.
6. **Research Classification/Restrictions:** This research falls under the 6.1 basic research classification and as such has no restrictions. However to facilitate close collaboration between AFRL and the student, frequent visits to WPAFB will be required. The student and faculty member are therefore required to be a citizen or permanent resident of the United States.
7. **Eligible Research Institutions:**



DAGSI (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati) NOTE: Topics submitted to DAGSI must be approved for public release. PA Approval #88ABW-2015-3698

AFIT (only)

USAFA (only)

If you are submitting a topic for the USAFA, indicate if you are also interested in sponsoring a USAF Cadet in summer 2015 (Average cost for USAF Cadet for 33 days is \$5000)

Yes

No

Public Release Pending