



Nanocrystalline Diamond Films for Thermal Management



Dr. Nirmal Govindaraju^a and Prof. Raj N. Singh (PI)^a

Grant # CBET-1133516

Technology Challenges

- ❑ Thermal management plays a critical role in several high technology areas: microelectronics, high power lasers, high power electronics
- ❑ Interfaces with poor thermal properties between components in thermal management systems are a significant bottleneck for effective heat transfer
- ❑ There is a critical need to develop smooth, high thermal conductivity interface materials for thermal management applications

Solution Approach

- ❑ Natural diamond has the highest known thermal conductivity
- ❑ Synthetic diamond films with micrometer* size crystals have high thermal conductivity, however their surfaces are very rough
- ❑ Diamond thin films synthesized with nanometer[†] size crystals have low thermal conductivity but exhibit smooth surfaces
- ❑ Central Idea: Develop composite diamond thin films which combine the properties of microcrystalline and nanocrystalline diamond

^a College of Engineering and Applied Sciences, University of Cincinnati, and College of Engineering, Architecture and Technology, Oklahoma State University

*1 micrometer = 10^{-6} meters; Average diameter of a human hair is 90 micrometers (approx.)

[†]1 nanometer = 10^{-9} meters; Distance between two diamond atoms is 0.36 nanometers (approx.)