

Wednesday, May 7th, 2008**11 am****Fung Auditorium
Powell-Focht BioEngineering Hall****NANO-DEVICES FOR ENHANCED COOLING
AND NOVEL MATERIALS SYNTHESIS****PROFESSOR DEBJYOTI (“DJ”) BANERJEE**Multi-phase Flows and Heat Transfer Lab
Texas A&M University**Abstract**

Our research efforts integrate thermal and nanotechnologies. The research activities are focused in:
(a) exploiting phase-change phenomena at the micro/nano-scale for thermal management (cooling), and
(b) using nano-lithography techniques combining MEMS and microfluidics for novel nano-materials synthesis.

In the thermal area – we are investigating micro-scale heat transfer phenomena in boiling. Micron-scale features in boiling cause the formation of “cold spots.” Using Carbon Nano-Tube (CNT) coated surfaces cooling was enhanced by ~300%, probably due to enhancement of these cold spots. Using silicon nano-fins - cooling was enhanced by ~120%. We have also demonstrated cooling enhancement by ~8-30% using nanofluids. Using Molecular Dynamics simulations these results were conclusively shown to be due to the “nano-fin” effect (surface rather than bulk effects).

DPN™ (Dip Pen Nanolithography) is a versatile technology that leverages microfluidic ink delivery systems with Scanning Probe Microscopy. At NanoInk Inc. Dr. Banerjee developed a novel commercial microfluidics platform called “Inkwells™” for nanolithography of bio-molecules (proteins and DNA). Subsequently at Texas A&M we have invented a process for synthesizing Carbon Nanotubes (CNT) at “room temperature” to enable CNT of a single chirality using DPN. DPN techniques in combination with microfluidics are also being developed for fountain pen nano-lithography, novel thermal nano-sensors for explosives detection (e.g., I.E.D.) and water quality monitoring using peptide-gold nano-particle assays.

Biographical Sketch

Before joining Texas A&M University in 2005, Dr. Banerjee was a Manager of Advanced Research & Technology (ART) group at Applied Biosystems Inc., CA (ABI) where he managed a team of 10 engineers (6 PhD). Dr. Banerjee received his Ph.D. in Mechanical Engineering (ME) from UCLA (with minor in MEMS). He received the “2001 Best Journal Paper Award” from the ASME Heat Transfer Division (HTD). He received 3 M.S. degrees and was invited to 4 national honor societies. At graduation he received “Best ME Student Award” at the Indian Institute of Technology (IIT), Kharagpur for his B.Tech. (Honors). He was ASEE/AFRL Summer Faculty Fellow in 2006 and 2007. He worked at TISCO, COVENTOR, NanoInk and CIPHERGEN Biosystems. His research interests are in thermo-fluidics (boiling), MEMS/ microfluidics and nanotechnology.