

ME DEPARTMENTAL SEMINAR

Friday, November 18, 2005

1:00pm – 2:00pm

2233 GG BROWN

**Professor Stephen Choi
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Energy Technology Div., #335
Argonne, IL**

“NANOFLUIDS FOR MEETING COOLING CHALLENGES” *

Abstract:

The development of many industrial technologies is hampered by a vital need for ultra-high-performance cooling. The conventional approach for enhanced cooling has reached its limits. Nanofluids conceived at Argonne National Laboratory are being developed to meet this need. A research team at Argonne has successfully created "nanofluids" by suspending nanoparticles in conventional heat transfer fluids. Nanofluids, stable suspensions of solid nanoparticles with typical length scales on the order of 1 to 100 nm, can conduct heat one order of magnitude faster than scientists had predicted possible. The realization that nanofluids have excellent thermal properties promises to bring about a revolution in cooling technologies. Because the intriguing thermal properties of nanofluids cannot be explained by conventional macroscopic theories, new theoretical models have been proposed. However, the validity of these competing theoretical models is hotly debated. The nanoscale structure of nanoparticles in nanofluids is being explored experimentally at Argonne's Advanced Photon Source. In related efforts, the mobility-enhanced energy transport of nanoparticles is being studied experimentally and theoretically. These efforts will lead to the development of a new model of energy transport in nanofluids, which takes into account the nanoparticle size, shape, structure, and mobility effects on the nanofluid thermal properties. Despite recent studies by my team and others, the basic mechanisms of energy transport in nanofluids remain incompletely understood. Therefore, this interdisciplinary research presents an opportunity to explore new frontiers of nanoscale thermal sciences for the design and engineering of next-generation coolants. In this talk I will cover a broad scope of nanofluids and highlight the state-of-the-art of this field and critical directions for future research.

Bio:

Dr. Choi joined Argonne in 1983 and has conducted research primarily in advanced fluids. His work on advanced fluids culminated in the invention of nanofluids. He proposed the concept of nanofluids and has led the nanofluid team to develop stable nanofluids with high thermal conductivities. He currently serves as the principal investigator of the nanofluid team. Dr. Choi received his bachelor's degree from the Seoul National University, his master's degree from the University of Texas at Austin, and his doctorate from the University of California, Berkeley, all in Mechanical Engineering. The nanofluid project has been named a top achievement by DOE's Office of Basic Energy Sciences in 2002 and 2003. He is the recipient of the University of Chicago's Distinguished Performance Award in 2005. He is author or co-author of more than 100 publications and holds 3 U.S. patents, including the one on nanofluids. He has given more than 20 invited presentations on nanofluids.

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