

Two Phase Flow Laboratory (TPFL)

Researches into two-phase flow and phase change heat transfer

Moo Hwan Kim



Education

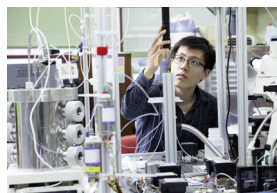
Ph.D. 1986 University of Wisconsin-Madison
M.S. 1982 Nuclear Engineering, Seoul National University
B.S. 1980 Nuclear Engineering, Seoul National University

Experience

2013~ President of Korea Institute of Nuclear Safety, KINS
2011~2013 Vice President for Planning, Pohang University of Science and Technology
2007~2011 Vice President for Admission and Student Affairs, Pohang University of Science and Technology
2007~2010 Nongovernmental delegates, Nuclear energy commission
2004~2006 Director of Nuclear Technology Program, KOSEF
2000~2001 Visiting Professor, Kyushu University, Japan
1994 Technical Advisor at Living System Research Lab. of LG Electronics
1993 Visiting Professor at Department of Nuclear Engineering and Engineering Physics, University of Wisconsin-Madison
1987~ Assistant, Associate and Full Professor at Department of Mechanical Engineering, Pohang University of Science and Technology
1986~1987 Research Scientist at University of Wisconsin-Madison for Prof. M.L. Corradini
1980~1982 Researcher at Korea Atomic Energy Research Institute

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This laboratory was founded in 1987. Since then, we have researched into the two phase flow and phase change heat transfer by using experiments and numerical analysis. In 1999, this laboratory was selected as a National Research Laboratory (NRL). In 2007, this laboratory established Fuel-cell Water management Global Research Center (FWGRC).

Principal research area

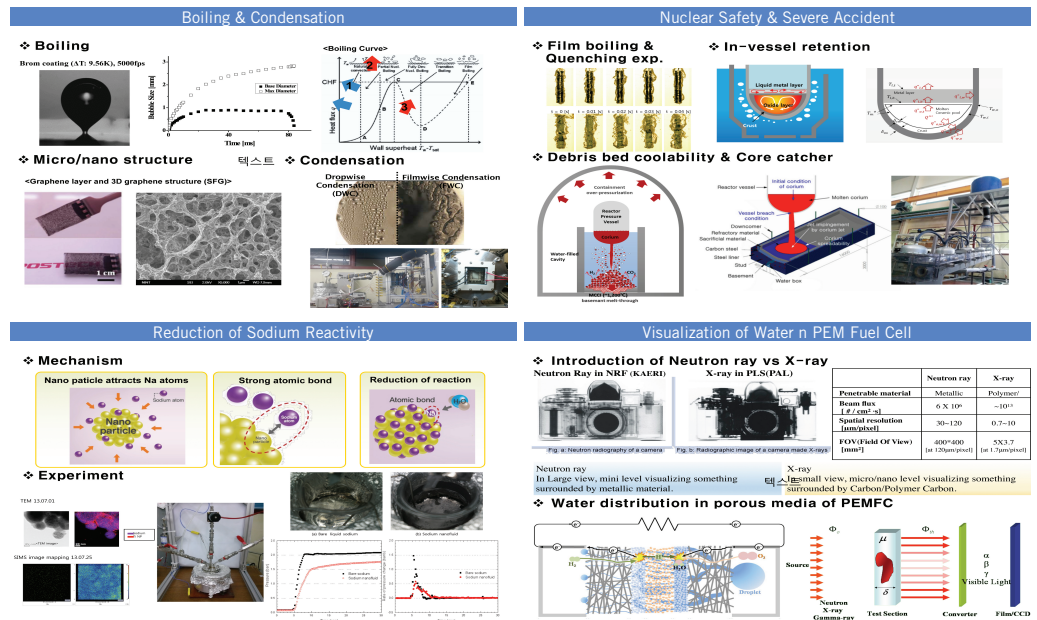
- Phase change heat transfer : condensation and boiling
- Heat transfer with nano-fluid, nano/micro structured surface
- Study on heat exchangers
- Nuclear power plant thermal-hydraulics
- Nuclear safety and Severe accident management
- Study of reduction in Sodium reactivity
- Study on fuel cell : water management
- Measurement technique using Neutron-Radiography and X-ray Radiography

The thermal system with nano/micro structures has many merits on its performance. There are several nano & micro structured surface bring about a breakthrough in the boiling heat transfer and critical heat flux. However, analysis and interpretation of those effect on to boiling is limited, and it need to be researched. This study may help not only the enhancement of the boiling performance but also understanding nano/micro scaled two phase system. In addition, we a new method for fabricating 3D structured graphene was developed with simple boiling method. This simply made graphene surface can be utilized in various industrial fields with superior properties such as thermal conductivity, transparency, and etc.

The issue of heat transfer at an area of nuclear power plants is very important to nuclear safety. Nuclear power plants use nuclear fuel like uranium oxide with high temperature to 2000°C; therefore, nuclear heat has to be transferred to coolant effectively because the heat is generated continuously at operation and decay heat remains at even an accident situation. We study heat transfer phenomena of film boiling and severe accidents in nuclear power plants, such as quenching of a nuclear fuel clad, external reactor vessel cooling, debris bed coolability, and steam explosion.

As Sodium-cooled Fast Reactor (SFR) has been considered for a new generation nuclear reactor, many reseachers have focused on the sodium characteristic. In TPFL, we tried to control (reduce) the reactivity of sodium using nano particle. It may bring about the advance in SFR nuclear reactor development.

Because the fuel-cell system attract as next generation energy system, fuel-cell system was developed on world-wide. The low-temperature fuel-cell systems (PEMFC, DMFC), which are applicable to portable system (e.g. cellular phone) and car. The water management in PEMFC is bottle-neck technique for high performance and commercial PEMFC. We study on water management in PEMFC with numerical and experiment. We use Neutron-Radiography and X-ray Radiography which is best technique to observe the phenomena in actual operating PEMFC.



Major Publications

- HangJin Jo, Massoud Kaviany, Seol Ha Kim, Moo Hwan Kim, "Heterogeneous bubble nucleation on ideally-smooth horizontal heated surface", International Journal of Heat and Mass Transfer, Vol. 71, pp.149-157, 2014
- Ho Seon Ahn, Ji Min Kim, Moo Hwan Kim, "Experimental study of the effect of a reduced graphene oxide coating on critical heat flux enhancement", International Journal of Heat and Mass Transfer, Vol. 60, pp. 763-771, 2012
- Ho Seon Ahn, Gunyeop Park, Joonwon Kim, and Moo Hwan Kim, "Wicking and spreading of water droplets on nanotubes", Langmuir, Vol.28, No.5, pp. 2614-2619, 2012
- Ho Seon Ahn, Chan Lee, Joonwon Kim and Moo Hwan Kim, "The effect of capillary wicking action of micro/nano structures on pool boiling critical heat flux", International Journal of Heat and Mass Transfer, 2011 Vol.55, Issue.1-3, pp.89-92
- Ho Seon Ahn, Hang Jin Jo, Soon Ho Kang, Moo Hwan Kim, "EFFECT OF LIQUID SPREADING DUE TO NANO/MICRO STRUCTURES ON THE CRITICAL HEAT FLUX DURING POOL BOILING ", Applied Physics Letters, Vol. 98, Issue 7, 2011