

# ILTAI KIM

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## RESEARCH INTERESTS

- Development of surface plasmon resonance (planar and localized SPR) imaging techniques, and its application in bio/nano fields and thermal/fluids. Plasmonics, Biophotonics.
- Micro and nanoscale fluidics and heat transfer, electrokinetics, biophysics, bio-MEMS, and micro-fabrication.
- Interaction phenomena between nanoparticles such as plasmon and exciton: Solar energy harvest
- Detection of thermal energy of nanoparticles using advanced three-dimensional microscopy technique
- Optical characterization of enzyme-hydrolysis of cellulose in biofuel production process.

## EDUCATION

- **Ph.D degree in Mechanical, Aerospace & Biomedical Engineering:** 2004~currently Ph. D Candidate **University of Tennessee, Knoxville.**
  - \* Ph.D degree course in Mechanical Engineering, Texas A & M University (TAMU): 2003-2004.
  - \* Thesis: *Label-free Mapping of Near-Field Transport of micro/nano fluidic phenomena Using Surface Plasmon Resonance (SPR) Reflectance Imaging Technique.*
- **M.S in Mechanical Engineering** - February 1994.  
**Pohang University of Science & Technology (POSTECH), Pohang, Korea.**
  - \* Thesis: *A study on the Plume Flow of Attitude Control Thruster and the Plume Impingement Phenomena on the Satellite Structure.*
- **B.S in Mechanical Engineering** – February 1992.  
**Pohang University of Science & Technology (POSTECH), Pohang, Korea.**

## PROFESSIONAL EXPERIENCE

- **Graduate Teaching Assistant**, UT, Spring 2008-present.
- **Graduate Research Assistant**, TAMU and UT, 2004-2008.
- **Research Engineer and Assistant Manager**, POSCO, Pohang, Korea, 1995-2003.
- **Lecturer**, POSCO, Design of combustion facility and furnace, Pohang, Korea, 1999.
- **Secretary in Munition**, Korea Army Force, HQ, 182 R, 62 D, Jochiwon, Korea, 1994-1995

- **Teaching Instructor, POSTECH, Flow visualization course funded by AFERC, Pohang, Korea, August, 1993.**
- **Graduate Research Assistant, POSTECH, Pohang, Korea, 1992-1994.**

## **HONORS, AWARDS, AND CERTIFICATIONS**

- **KUSCO-KSEA Graduate Student Scholarship, 2008.**
- **SARIF Summer GRA Award at University of Tennessee, 2008.**
- **Korean honor scholarship from Korea government, 2004.**
- **A scholarship from department of mechanical engineering at TAMU, 2004.**
- **A director's award for the excellent engineering work, The development of RH-OB oxygen enrichment burner, Pohang, POSCO, 2000.**
- **CEO's award for the excellent paper (The heat technical conference), The thermal fluid analysis of the reheating furnaces of wire rod mills by computer simulation for the modification of dam structures inside the furnace, Gwangyang, POSCO, 1999.**

## **PUBLICATIONS AND PRESENTATIONS**

### **Refereed Journal Publications**

- I. T. Kim and K. D. Kim, Unveiling of hidden complex cavities formed during nanocrystalline self assembly, *Langmuir*, *Online published as of Aug. 29, 2008*, selected as a cover page in issue 4 2009.
- I. T. Kim and K. D. Kihm, Label-Free and Near-Field Mapping of Molecular Diffusion (Saline Solution/Water) Using Surface Plasmon Resonance (SPR) Refractive Index Field Imaging, *Journal of Heat Transfer* **130**, 080906-1, 2008.
- I. T. Kim and K.D. Kihm, Full-field and real-time SPR imaging thermometry, *Optics Letters* **32**, 3456~3458, 2007.
- I. T. Kim and K.D. Kihm, Real-time and full-field detection of near-wall salinity using Surface Plasmon Resonance (SPR) reflectance, *Analytical Chemistry* **79**, 5418~5423, 2007.
- I. T. Kim and K. D. Kihm, Surface plasmon resonance (SPR) reflectance imaging: A label-free/real-time mapping of microscale mixture concentration fields (Water+Ethanol), *Journal of Heat Transfer* **129**, 930, 2007.
- I. T. Kim and K.D. Kihm, Label-free visualization of microfluidic mixture concentration fields using a surface plasmon resonance (spr) reflectance imaging, *Experiments in Fluids* **41**, 905~916, 2006.
- J. G. Kim, K. Y. Huh, and I. T. Kim, Three-dimensional analysis of the walking beam type slab reheating furnace in hot strip mills, *Numerical Heat Transfer, Part A* **38**, 589~609, 2000.

### **Submitted Journal Papers**

- B. A. Green, R. Steward, I. T. Kim, C. K. Choi, P. K. Liaw, K. D. Kihm, and Y. Yokoyama, In situ observation of pitting corrosion of the Zr50Cu40Al10 bulk metallic glass, *Intermetallics*.

### **Journal Papers in Preparation**

- I. T. Kim and K. D. Kihm, SPR reflectance correlation with near-field effective refractive index of nanofluids (47 nm Al<sub>2</sub>O<sub>3</sub>) (for *Nano Letters*)
- I. T. Kim, S. K. Park, and K. D. Kihm, Optical characterization of enzyme-hydrolysis of cellulose using SPR reflectance technique (for *Cellulose or Langmuir*)
- I. T. Kim and K. D. Kihm, Development of magnetic micro ball valve system for cell separation (for *Sensors & Actuators B*).

- J. S. Park, I. T. Kim, and K. D. Kihm, A noninvasive method for evaluating microfluidic mixing using diffraction imaging of fluorescent nanoparticles (for *Physics of Fluids*).
- I. T. Kim and K.D. Kihm, Label-free visualization of microfluidic mixture concentration fields using a surface plasmon resonance (SPR) imaging sensor and CFD simulation of mixing dynamics (for *Physics of Fluid*).

### **Conference Papers**

- I. T. Kim and K. D. Kihm, Label-free detection of near-field microfluidic properties using surface plasmon resonance (SPR) reflectance mapping, US-Korea Conference on Science, Technology, and Entrepreneurship, San Diego, CA, Aug. 14-17, YGPF-8, 2008.
- I. T. Kim, K. D. Kihm, and D. M. Pratt, Label-free detection of full-field microfluidic concentration and temperature Fields by surface plasmon resonance (SPR) reflectance imaging technique, 18th International Symposium on Transport Phenomena (ISTP-18), Daejon, Korea, Aug. 27-30, pp.244-258, 2007.
- I. T. Kim and K. D. Kihm Label-free and real-time imaging of microscale mixture concentration fields using Surface Plasmon Resonance (SPR) reflectance, APS 59th Annual Meeting of the APS Division of Fluid Dynamics, Tempa Bay, Florida, Nov. 21, LC00009, 2006.
- I. T. Kim, Y. J. Park, The establishment of the 4 MIX GAS(by-product gases and LNG) supply system to the furnaces of the rolling mills in Pohang through the fuel compatibility study, The Energy Technical Conference, POSCO, Pohang, Korea, June 12, 2001.
- I. T. Kim, Y. W. Lee and N. K. Lee, The establishment of optimal standard of reheating furnaces in wire rod mills for energy saving by experiment and three dimensional thermal fluid analysis of reheating furnaces , the 14th workshop of energy saving technology, The Korea Institute of Energy Technology, Daejon , Korea, Oct. 4~6, 1999.
- J. G. Kim, K. Y. Huh and I. T. Kim, .Three-dimensional analysis of the walking beam type slab reheating furnace in hot strip mills, spring meeting, The Korean Institute of Computational Fluid Engineering, Taejon, Korea, May 28, 1999.
- I. T. Kim, K. Y. Huh and C. H. Chun, A study on the plume flow of attitude control thruster in satellite, The Korean Institute of Aeronautics and Space, The national air force school, Cheongju, Korea, April, 1993.

### **Invited Presentations**

- I. T. Kim, Label-free Mapping of Near-field Transport and Optical Properties Using Surface Plasmon Resonance (SPR) Reflectance Imaging, Argonne National Lab, Chicago, IL, Oct. 2, 2008.
- I. T. Kim, Label-free Mapping of Near-field Transport Properties Using Surface Plasmon Resonance (SPR) Reflectance Imaging, NIST, Gaithersburg, MD, May 22, 2008.

### **Presentations**

- I. Kim and K. D. Kihm, Unveiling Hidden Cavities Formed During Nanofluidic Self Assembly, Photogallery in the panel of visualization of heat transfer in 2008 IMECE, Boston, MA, Nov. 4, Session 10-21-1, 2008.
- I. T. Kim and K. D. Kihm, Label-free and near-field mapping of dynamic mixing of saline (10%) + water using surface plasmon resonance (SPR) reflectance imaging, Photogallery in the panel on innovative imaging techniques in 2007 IMECE, Seattle, Washington, Nov. 13, Session 8-16-1, 2007.
- I. T. Kim and K. D. Kihm, Label-free and real-time imaging of microscale mixture (water+ethanol) concentration fields using surface plasmon resonance (SPR) reflectance, Photogallery in the committee of visualization of heat transfer in 2006 IMECE, Chicago, Illinois, Nov. 5, 2006.
- I. T. Kim, A stability analysis of the main pipe hangers and modification in power plant, POSCO, Pohang, Korea, June 20, 2003.

- I. T. Kim, A Study on the establishment of the optimal refurbishment method of the gas turbine in LNG power plant (111MW, ABB, GT11N2), POSCO, Pohang, Korea, June 18, 2002.
- I. T. Kim, The mechanical engineering of the replacement of the sealing equipment of the COREX Furnace GAS Holder, The Publication of The Engineer's Research, POSCO, Pohang, Korea, Mar. 2001.
- I. T. Kim, Y. W. Lee and B. O. Kim, The development of the RH-OB Burner system in steel making process in Pohang works by experiment and thermal-fluid analysis, The Energy Technical Conference , POSCO, Pohang, Korea, June 15, 2000.
- I. T. Kim, N. K. Lee and Y. W. Lee, The thermal fluid analysis of the reheating furnaces of wire rod mills using commercial package PHOENICS for the modification of the dam structure inside the furnace, The Energy Technical Conference, POSCO, Kwanyang, Korea, Mar. 3, 1999.
- I. T. Kim, Y. W. Lee, C. M. Kim, Y. J. Park, K. Y. Park, K. S. Sakong, and S. M. Cho, The development of the technology of the thermodynamic engineering of the 260T/H reheating furnace in Pohang works, The Celebration Conference of professor Chun's 60th birthday anniversary, POSTECH, Korea, Dec. 28, 1998.
- I. T. Kim, K. Y. Park, S. Y. Kim and C. W. Lee, The modification of the burner system in the pre-heater of the billet tundish in steel making process by numerical analysis and experiment, The POSCO Technology Conference, POSCO, Pohang, Korea, Aug. 1997.

## **RESEARCH AND ENGINEERING PROJECTS**

- 04/04~08/05 Micro-scale investigation of capillary pumped heat transport systems (CPHTS) with a binary mixture working fluid, Air Force.
- 04/03~09/04 The study on the improvement of combustion instability of gas turbine (GT11N2), Pohang, POSCO.
- 01/02~12/02 The energy saving by heat efficiency increase and air leak decrease in GAH(gas air heater) in power plant(100MW), POSCO.
- 12/01~11/02 The establishment of the optimal refurbishment maintenance in the GAS Turbine of the LNG power plant, POSCO.
- 07/00~06/01 The development of a computer program for the pipe network analysis of by-product gases at Pohang works, POSCO.
- 03/98~12/99 The development of the RH-OB Burner in steel making process in Pohang works by experiment and numerical analysis, POSCO.
- 01/99~12/99 The development of the 3Gcal/H burner of the reheating furnace in the Plate Rolling Mills by numerical analysis and experiment, POSCO.
- 07/97~06/98 The development of the technology of the thermodynamic engineering of the 260T/H reheating furnace in Pohang works by experiment and numerical analysis, POSCO.
- 01/98~12/98 The development of the analysis program for the prediction of the temperature of the outer casing of the teeming ladle by IHCP method, POSCO.
- 05/93~12/93 A study on the Interaction between satellite structure and thruster plume flow, KARI.
- 02/92~12/92 A study on the plume flow of the satellite attitude control thruster, KARI.

## **WRITING RESEARCH PROPOSALS**

- High resolution thermal energy detection in photothermal therapy of tumors with 3-D wide-field surface plasmon resonance microscopy.

- Development of a real-time and full-field SPR biosensor to quantitatively measure the enzymatic hydrolysis of cellulose.
- Development of the Novel Bio/Chemical Sensor applying Liquid Core Optical Ring Resonator with micro-fluidic AC Electrokinetic Mixing.
- The study on the improvement of combustion stability of gas turbine (GT11N2), Pohang, POSCO.
- The development of the analysis program for the prediction of the temperature of the outer casing of the teeming ladle by IHCP method, Pohang, POSCO.
- A study on the Interaction between satellite structure and thruster plume flow, KARI.

## **INTERNAL REPORTS**

- I. T. Kim and Y. Choi, The study on the steam turbine efficiency increase by blade coating and seal leak decrease, POSCO, Pohang, Korea, Sep. 2002.
- I. T. Kim and S. H. Yeon, The structural analysis of the existing BFG Holder(100,000m<sup>3</sup>) using commercial FEM package MIDAS, The Environ. & Energy Dept., POSCO, Pohang, Korea, Oct. 2001.
- I. T. Kim, The engineering of the piping network and booster performance for the increase of the LD Gas recovery, The Environ. & Energy Dept., POSCO, Pohang, Korea, Aug. 2001.
- I. T. Kim, S. H. Yeon, and Y. H. Kim, The piping network analysis for the replacement of the main BFG pipes and the basic design of the new polygonal seal oil type BFG Holder(120,000m<sup>3</sup>) in Pohang works, The Environ. & Energy Dept., POSCO, Pohang, Korea, Feb. 2001.
- I. T. Kim, Y. K. Nam, and S. K. Jeong, The development of the technology that prevent the pollution and the oxidation of the outer shell plate of the seal water type LD Gas Holder(40,000m<sup>3</sup>), The Environ. & Energy Dept., POSCO, Pohang, Korea, Aug. 2000.
- I. T. Kim, A study of the mechanism of the gas holder(40,000~150,000m<sup>3</sup>) and the function of holder seal oil in POSCO, The Environ. & Energy Dept., POSCO, Pohang, Korea, May 2000.
- I. T. Kim, S. S. Lee, and B. Y. Choi, The energy diagnosis about the entire #1 Plate Mills for energy saving using the ESCO techniques, The Plate Rolling Dept., POSCO, Pohang, Korea, Jan. 2000.
- I. T. Kim, The transient heat transfer analysis of the insulation cover of the billet for energy saving in the Wire Rod Mills by experiment and numerical method, The Wire Rod Mills Dept., POSCO, Pohang, Korea, Dec. 1999.
- I. T. Kim, The calculation of the heating load of the preheating burner in RH-OB vessel by transient heat conduction analysis(including radiation effect), The Facility Dept., POSCO, Pohang, Korea, Dec. 1999.
- I. T. Kim, The thermodynamic engineering of the reheating furnaces in H-beam mills, The Facility Dept., The Incheon Steel Company, Incheon, Nov. 1999.
- I. T. Kim and Y. W. Lee, The engineering of the piping systems(valve stand) of the RH-OB preheating equipment, The Facility Dept., POSCO, Pohang, Korea, Oct. 1999.
- K. S. Sakong and I. T. Kim, The fundamental study of the regenerative burner in radiant tube heating system, The Facility Dept., POSCO, Pohang, Korea, Sep. 1999.
- S. H. Lee, J. H. Ahn, and I. T. Kim, The measurement of the temperatures of the new oxygen enrichment burner and the design of the optimal material. The Facility Dept., POSCO, Pohang, Korea, Aug. 1999.
- I. T. Kim and Y. W. Lee, The numerical transient heat transfer analysis of the annul type roll in the Hot Strip Mills under the mixed condition of radiation and conduction heat transfer, The Hot Rolling Dept., POSCO, Pohang, Korea, July 1999.
- I. T. Kim and Y. W. Lee, The calculation of the optimal heating load and the setting of the proper zonal temperatures by transient 2-D heat conduction analysis and furnace engineering, The Wire Rod Mills Dept., POSCO, Pohang, Korea, June 1999.

- I. T. Kim and B. W. Seo, The optimal design of the heat exchanger of the reheating furnace, The Hot Rolling Mills Dept., POSCO, Pohang, Korea, May 1999.
- I. T. Kim and Y. W. Lee, The study for the setting of the optimal gas temperatures of the reheating furnace under the condition of varying the slab's size, kinds, residence time and exhaust temperature by transient two dimensional finite difference method, The Wire Rod Mill Dept., POSCO, Pohang, Korea, Apr. 1999.
- I. T. Kim, B. W. Kim, and Y. W. Lee, The measurements of the billet's increasing temperatures in the reheating furnace using SUS type thermocouples and the development of the computer program that simulates the increasing billet's temperatures, The Wire Rod Mill Dept., POSCO, Pohang, Korea, Mar. 1999.
- I. T. Kim, B. W. Kim, and Y. W. Lee, The transient heat conduction analysis of the #1 SM #2RH vessel and the establishment of the optimal standard about the quantities of the fuel and air for 48 hours according to the given drying and heating pattern, The Steel Making Dept., POSCO, Pohang, Korea, Feb. 1999.
- I. T. Kim, S. M. Cho, and S. D. Hong, The analysis of the energy consumption pattern about #2 Hot Strip Mill, The Energy Dept., POSCO, Pohang, Korea, Jan. 1999.
- I. T. Kim and S. H. Lee, The heat diagnosis about the reheating furnaces such as hot strip mills, plate mills and wire rod mills, the boilers of the power plant, the cokes ovens, rotary kilns and heat treatment furnaces, POSCO, Pohang, Korea, Dec. 1996~1998.
- I. T. Kim and Y. J. Park, The numerical analysis of the heat transfer mechanism and the engineering design of the cooling device in the #1 Plate Rolling Mills, The Plate Rolling Dept., POSCO, Pohang, Korea, Dec. 1998.
- I. T. Kim and Y. W. Lee, The analysis of the cause of the heating billet's deformation in the reheating furnaces of wire rod mill and the proposal of the improvement plan, The Wire Rod Mill Dept., POSCO, Pohang, Korea, Nov. 1998.
- I. T. Kim, The thermal fluid analysis of the effect of the dam in the bloom furnace by using commercial package, PHOENICS, The Wire Rod Mills Dept., Pohang, Korea, Oct. 1998.
- I. T. Kim, The comparative analysis of the effects of the radiation heat transfer caused by gas and solid in the reheating furnaces, The Hot Rolling Dept., POSCO, Pohang, Korea, Sep. 1998.
- I. T. Kim, K. Y. Park, and Y. W. Lee, The calculation of the proper heat capacities of the burners of the reheating furnaces such as the hot rolling mills and plate rolling mills for the replacement of the old burners, The Facility Dept., POSCO, Pohang, Korea, Aug. 1998.
- I. T. Kim and Y. W. Lee, The calculation of the proper cooling load of the H-table roller in #2 Hot Strip Mill using transient 2-D heat conduction analysis, The Facility Dept., Pohang, Korea, July 1998.
- I. T. Kim, The heat transfer analysis of the COREX dust removal burner using NISA for the modification of the design of the burner, Pohang, Korea, June, 1998.
- I. T. Kim, B.W. Kim, and S.Y. Kim, The investigation of the cause of the white smog in the cokes oven, The Chemical Making Dept., Pohang, Korea, May 1998.
- I. T. Kim, A study on the desalination processes using the exhaust waste heat of the reheating furnaces, The Facility Dept., POSCO, Pohang, Korea, Apr. 1998.
- I. T. Kim, K. Y. Park, and Y. W. Lee, A study on the oxygen enrichment combustion and its application to the removal of the slag from the Torpedo Ladle Car, The Steel Making Dept., POSCO, Pohang, Korea, Dec. 1997.
- I. T. Kim, K. Y. Park, and Y. W. Lee, The heat transfer study of the skid pipe inside reheating furnace by numerical analysis(analytic and FEM) and experiment, Pohang, Korea, Sep. 1997.
- I.T. Kim, The fundamental thermal fluid analysis of the COG combustion of the billet tundish pre-heater using the commercial package PHOENICS, The Steel Making Dept., POSCO, Pohang, Korea, July 1997.
- K. Y. Park, I. T. Kim, and Y. W. Lee, The establishment of the proper pattern of the keeping of the heat

in reheating furnaces for energy saving by numerical analysis, The Plate Rolling Mills Dept., POSCO, Pohang, Korea, July 1997.

- S. H. Lee , J. H. Ahn, I. T. Kim, and K. Y. Park, The study on the investigation of the cause of the crack of radiant tube and the optimal design, The Plate Rolling Mills Dept., POSCO, Pohang, Korea, June 1997.
- I. T. Kim and S. M. Cho, The calculation of the necessary cooling load to make shorten the existing cooling periods in the reheating furnaces by transient heat conduction analysis(including radiation effect), The Facility Dept., POSCO, Pohang, Korea, May 1997.
- I. T. Kim and K. Y. Park, A study on the drying mechanism of the sludge in the Chemical Plant and the engineering design of the drying equipment, The Chemical Making Dept., POSCO, Pohang, Korea, Mar. 1997.
- B. W. Kim, C. S. Kim and, I. T. Kim, The problem solving of the pre-heating equipment of the #2STS Steel Making Plant such as the temperature deviation, The STS Dept., POSCO, Pohang, Korea, Dec. 1996.
- I. T. Kim and K. Y. Park, The study of the radiation heat transfer mechanism of the heating treatment furnace in the plate mills and the analysis of the heating patterns under the condition of varying residence time and the exhaust temperature, The Plate Mills Dept., POSCO, Pohang, Korea, Oct. 1996.
- I. T. Kim, The heat conduction analysis of the electric equipment by analytic and commercial package NISA, The Facility Dept., POSCO, Pohang, Korea, Aug.1996.
- I. T. Kim and K. Y. Park, A study on the heat transfer and heat balance of the organic coating furnace, The Facility Dept., POSCO, Pohang, Korea, June 1996.
- I. T. Kim, A study of the radiation and conduction heat transfer mechanism of the Continuous Anneal furnace and the prediction of the temperature of the annul-type roll by analytic solution, The Cold Rolling Dept., POSCO, Pohang, Korea, Mar. 1996.
- I. T. Kim, S. M. Cho and, S. Y. Kim, The design of the cooling nozzle for the protection of the non uniform shape of the strip in the Electric Steel Plant, The Facility Dept., POSCO, Pohang, Korea, Dec. 1995.

## **PATENTS**

- The cooling nozzle in electronic steel making plant (K0018).
- The preheating burner of a RH-OB Vessel in steel making process (in progress).

## **PROFESSIONAL SOCIETTY MEMBERSHIPS**

- American Society of Mechanical Engineers (ASME).
- American Physical Society (APS).

## REFERENCES

**Kenneth D. Kihm**  
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