

Environmental Thermofluids Engineering Laboratory (EnvTF)

In search of particles of all sizes and their motion in industrial and biomedical systems

This laboratory (EnvTF) was founded as one of the founding laboratories in the Mechanical Engineering Department at the same time of the University's birth (1987), entitled as the Particle Technology Laboratory (PTL). Name of the lab was changed to the Environmental Thermofluids Engineering Laboratory in 1996, and was designated as the National research Lab (NRL) in 2008.

Research efforts are mainly divided into two different fields, Aerosol Science and Bio Fluids Engineering, and a variety of researches have been performed in other areas, too. Numerical simulation is widely used, ranging from FDM and FEM to Monte Carlo and MD, and this laboratory is well known for the analysis of flow and particles in the human lung airways and also in the cyclones.

Research topics are summarized as:

- 1) Particle Technology
 - nano contamination control
 - generation of aerosols and fine/ultra-fine particles with various properties
 - modeling particle motion in turbulent flow fields
- 2) Air Pollution Control
 - dust collectors ; ESP (electrostatic precipitators), cyclones, special dust collectors for industrial applications
 - vortex vent
 - vortex tube
 - vortex scrubber for CO2 capture
- 3) Biofluids Engineering
 - air flow and particle deposition in the human lung airway
 - optimality principles in the living organs
- 4) Other topics in fluids and heat transfer
 - flow and heat transfer in porous media
 - inverse heat transfer
 - micro supersonic nozzle to be used in micro satellites
 - vacuum technology

This laboratory holds two world records ; i) removal of 10nm contaminant particles using the supersonic particle beam and ii) 5D ventilation depth using the vortex vent.

Jin Won Lee



Education

Ph.D. 1984 Northwestern Univ.(ME)
 M.S. 1977 KAIST(ME)
 B.S. 1975 Seoul Nat'l Univ. (ME)

Experience

2001 R&D Program Director, KOSEF
 1987~ Professor, Pohang University of Science and Technology
 1984~1987 Senior Researcher, KIST
 1984~1984 Post Doc., Northwestern Univ.
 1977~1980 Researcher, KIST

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Aerosol Science

Generation and analysis of aerosol motion MD simulation of nano particles
 Nano contamination control with particle beam

Ventilation and Air Pollution Control

Pollution control : dispersion, deposition **Filtration technology** : cyclone, EP, filter etc
Ventilation techniques : vortex vent

Biofluids Engineering

Flow and Particle dispersion / deposition in lung Morphology modeling of human bronchial tree Breathing dynamics of alveoli

Micro Supersonic Flow

Micro thruster nozzle design Satellite contamination control Nano particle generation

Major Publications

- W.S. Kim and J.W. Lee, A New Collection Efficiency Model Based on Boundary Layer Characteristics for High Efficiency Cyclones, *AIChE J.* 43(10), 2446-2455 (1997)
- J.W. Lee, I.H. Kim, M.K. Choi and S.J. Kwon, Optimum Nozzle Angle of a Micro Solid-propellant Thruster, *Nanoscale and Microscale Thermophysical Engineering*, 15(3), 165-178 (2011. 8)
- Y.B. Lim, S.M. Lee, J.W. Lee, Characteristics of ventilating flow generated by a rotating swirler in a vortex vent, *J. Fluids and Structures*, 27(3), 427-437 (2011. 4)
- Jin W. Lee and Eugene Lee, Fluid-dynamic optimality in the generation-averaged length-to-diameter ratio of the human bronchial tree, *Medical and Biological Engineering and Computing*, 45(11), 1071 (2007. 11)
- Inho Kim, Kwangseok Hwang and JinWon Lee, Removal of 10-nm Contaminant Particles from Si Wafers Using CO2 Bullet Particles, *Nanoscale Research Letters*, 7(1), 211 (2012. 4)
- Y.B. Lim, M.K. Choi and J.W. Lee, Performance Characteristics of CO2 Capture with Aqueous Ammonia in a Single-Nozzle Spray Tower, *Industrial & Engineering Chemistry Research*, 52(43), 15131 (2013. 9)

