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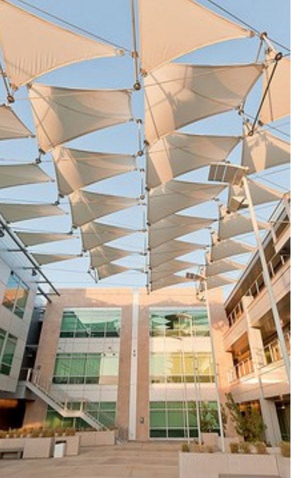

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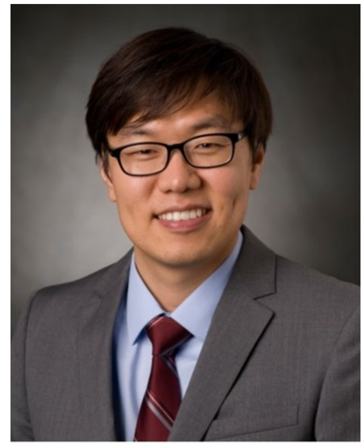

Donghyun Rim, Ph.D.

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Department of Architectural Engineering
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Friday, May 6, 2016
WCH Room 205/206
11:10-12:00PM

Dynamic behavior of airborne ultrafine particles in buildings

Abstract:

Indoor ultrafine particles (UFP, < 100 nm) emitted from combustion and consumer products lead to elevated human exposure to UFP. Once emitted from a source, indoor particles undergo aerosol transformation processes such as coagulation and deposition. Coagulation effect can be significant during the source emission due to high number concentration and high mobility of UFP. However, few studies have estimated size-resolved UFP source emission strengths by considering coagulation. The objective of this study is to characterize size-resolved UFP emission strength by considering coagulation in addition to deposition and ventilation in a realistic setting.

Experimental investigations were performed in a full-scale test building to examine UFP emissions from three common indoor UFP sources: electric stove, natural gas burner, and paraffin wax candle. Size- and time-resolved concentrations of UFP ranging from 2 nm to 100 nm were monitored using a Scanning Mobility Particle Sizer (SMPS). Based on the temporal evolution of particle size distribution during the source emission period, unimodal and log-normal source emission rates were determined using a material-balance modeling approach.

The results indicated that for a given UFP source, the source strength varied with particle size and source type. The geometric mean of the size-resolved source emission ranged from 5 to 8 nm for both electric and gas stoves while it ranged between 3 and 4 nm for the candle. These results reflect that majority of the primary particles originated from indoor combustion or high temperature process are smaller than 10 nm. The discrepancy in estimates of source strength due to coagulation effect was observed up to a factor of 8, implying that previous studies on indoor UFP source strengths considering only deposition and ventilation might have largely underestimated the true values of UFP source strengths.

About the Speaker:

Dr. Donghyun Rim is a James L. Henderson Jr. Memorial Assistant Professor in Architectural Engineering at Pennsylvania State University. His research focuses on indoor aerosol dynamics, transport of reactive organic gases around human body, and air quality in energy efficient buildings. Before joining Penn State in 2014, Dr. Rim worked as a postdoctoral researcher at UC Berkeley and LBNL, and studied indoor environmental quality in tropical climates. Dr. Rim earned his Ph.D./M.S. degrees in Environmental Engineering from the University of Texas at Austin. He earned his B.S. degree in Civil and Environmental Engineering from Hanyang University in Seoul, Korea.