Department of Chemical and Materials Engineering
COLLEGE OF ENGINEERING

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: March 2, 2009

The Department of Chemical and Materials Engineering is pleased to offer the following research project for the summer of 2009. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and, if possible, develop a timetable for the twelve-week research period.

CONTROLLING NANO-PARTICLES IN ENGINE EXHAUST

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PROJECT DESCRIPTION

Nanoparticles form in conditions far from equilibrium such as at high temperatures and under conditions of high saturation. Often scientists are able to control these conditions to produce unique material properties such as in the synthesis of catalytic nanoparticles and other materials. However, it has recently become obvious that such non-equilibrium conditions are common in processes where nanoparticles are unintentionally produced such as in engines and in industrial processes. Because nanoparticles are difficult to measure, especially in process streams such as in engine exhaust streams, it is important to identify and quantify the unintended exposure to these materials in our environment. This problem is particularly acute in the urban setting and among young people. Recent studies have shown that one of the prime sources of exposure to nanoparticulates is from diesel exhaust, particularly diesel school buses where some of the highest exposures to children occur.

We have recently developed an in situ technique using x-ray scattering at synchrotron facilities (CHESS at Cornell and APS at Argonne National Laboratories) that can for the first time directly quantify nanoparticles in Diesel exhaust during engine operation. The measurements involve bringing a diesel engine to a synchrotron national user facility and using small-angle x-ray scattering to study the particle evolution under transient engine operation. We hope to extend these initial in situ quantifications of the dynamics of nanoparticle growth under variable engine conditions, fuel additives, fuel types and exhaust treatment systems and as a function of residence time (position) in the exhaust stream.