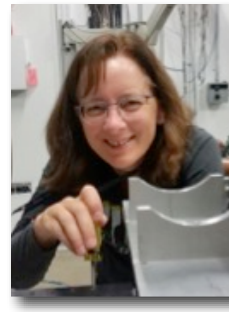
# Mechanical Engineering Department Seminar

**3:35pm November 16, 2016**
**1130 Mechanical Engineering**
**111 Church Street SE, Minneapolis, MN 55455**



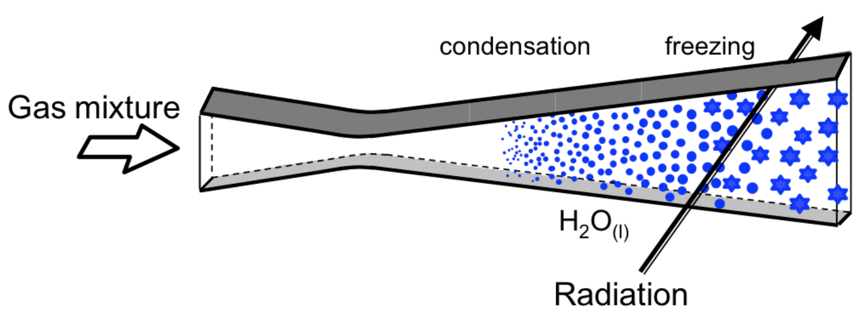
# From Molecules to Nanocrystals in Supersonic Flow: Alkanes Versus Water

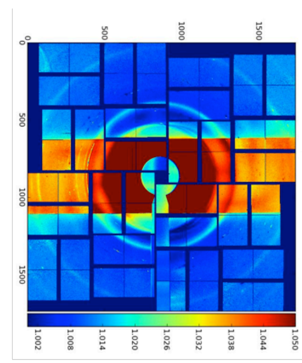

## Barbara Wyslouzil

Professor; Department of Chemical and Biomolecular Engineering, Ohio State University



Nanometer sized particles, droplets or crystals, form both in the environment and in large scale industrial processes. Accurate predictions of the phase transition rates, and the phase or structure of the particles, are critical for developing reliable models of industrial processes, climate, and atmospheric chemistry. From a fundamental point of view, particles with radii < 10 nm are also important because they lie in the critical transition zone between large molecular clusters and bulk materials. This talk will summarize our recent work following particle formation and freezing in two very different, highly super-cooled systems –water and a series of alkanes. Particles are formed in supersonic nozzles, and the system is characterized using a range of in situ techniques including small angle X-ray scattering (SAXS), wide angle X-ray scattering (WAXS), infrared spectroscopy, and pressure measurements. For water, the small droplet size and the rapid cooling rate means that in some cases liquid water only begins to freeze at ~202 K – a temperature that is well below the homogeneous freezing limit for bulk water or even micron size water droplets. Rather than forming hexagonal ice I, freezing produces stacking default ice I. For the n-alkanes we observe a distinct decrease in the size of the droplets as they freeze – in one case far more than expected. Finally, by combining the complimentary techniques we have indirect evidence that for the alkane drops the phase transition is initiated by surface freezing.

**Bio:** Barbara Wyslouzil is a Professor of Chemical and Biomolecular Engineering, as well as Chemistry and Biochemistry, at the Ohio State University. She received her B.Sc. in Mathematics and Engineering from Queens University, Kingston Ontario in 1980. She worked for the Alberta Research Council from 1981-1986 while earning an MSc in Chemical Engineering from the University of Alberta in 1985. Finally, she obtained her Ph.D. in Chemical Engineering from the California Institute of Technology in 1992. Her research is best described as fundamental aerosol physics. Topics of interest include developing methods to measure nanoparticle formation, growth, and freezing rates as well as elucidating the structure of multi-component nanoparticles. She has served on the board of the American Association for Aerosol Research (AAAR), including the role of president. Her awards include an NSF Career Award as well as the Kenneth B Whitby Award from the AAAR.