Nanomaterials and Nanoaerosols: Sources, Concerns and Analytical Approaches

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The fast development and growing use of nanomaterials are associated with their distinctive physico-chemical, electrical, optical and other characteristics. The use of engineered nanomaterials is now widespread and rapidly expanding into an increasing array of products and applications. This process leads to a growing potential for environmental and human exposure at all stages of nanomaterials' life cycle: from production of raw materials to manufacturing of products, throughout product life, and during and after disposal.

The second important class of nanosized objects is incidental nanoparticles. Although not engineered, incidental nanoparticles from natural and anthropogenic sources, such as combustion, can have distinct properties due to their dispersion at nanoscale. Evidence is emerging that incidental nanoparticles, notably the ultrafine air pollution particles, cause adverse biological effects due to their dispersion state and structure in a way similar to engineered nanomaterials. The growing evidence for potential adverse health an environmental effects of nanomaterials and incidental nanoparticles mandates their more extensive characterization and monitoring as well as control of synthesis and manufacturing processes. These concerns demand better analytical techniques and characterization approaches. Notably, the development of physical characterization techniques for nanomaterials has progressed at a faster pace than the development of chemical characterization techniques, creating an acute need and opportunity for analytical chemists to address this gap.

The development of chemical characterization techniques for nanomaterials and ultrafine particles presents a research challenge due to low sample quantities, necessity to characterize different size fractions within the nanosize range, volatility and instability of nanosized particles, particularly during and after sampling, and complexity of the mixtures and matrices where nanosized or nanostructured objects are dispersed.

The seminar will briefly introduce the field of nanotechnology and the key concepts, provide the motivation for my research and the challenges I strive to address through my work and focus on my research in the development of sampling and characterization techniques for nanomaterials, the effects of matrices and environmental factors, and the vision of my future work stemming from this expertise.