

Tom Peters' Laboratory Research Group at The University of Iowa

<http://myweb.uiowa.edu/tpeters/>

Thomas M. Peters
The University of Iowa
Occupational and Environmental Health
100 Oakdale Campus, #102 IREH
Iowa City, IA 52242-5000
phone: 319-335-4436
email: thomas-m-peters@uiowa.edu



We seek to collaborate with companies that incorporate engineered nanoparticles into products.

We have funding for to develop and use novel personal sampling methods to assess airborne exposure to engineered nanoparticles through the National Institute of Occupational Safety and Health (Peters, PI; K01OH009255-01).

We have developed novel personal samplers:

(1) A real-time monitor to measure personal exposure in units of surface area concentration.

- Ideal for attributing elevated exposures to specific work tasks and/or practices.

(2) A full-shift monitor for determining particle size distribution, chemistry, and morphology.

- Compatible with 8-hr sampling typical of industrial hygiene monitoring.

(3) A passive monitor for assessing chronic exposures.

- Simple, light-weight sampler used as a dosimeter to relate exposures to chronic health effects.

Example Projects:

(1) Task-based assessment of exposures in working with epoxies that contain carbon nanotubes.

- Use real-time monitor to identify relative magnitude of exposures associated with different tasks (e.g., epoxy preparation, coarse sanding, and final preparation).
- Apportion exposures within- and between-workers to inform control strategies.
- Evaluate the effectiveness of personal and/or administrative controls.

(2) Characterize the composition and morphology of airborne particulate exposures.

- For the passive and full-shift samplers, output may be expressed as particle number concentration, surface area concentration, or mass concentration by particle size.
- Chemistry and morphological analysis available to assess fraction of particles that are 'engineered' from those that are 'incidental' by products.

Our Laboratory Group:

Led by Dr. Thomas Peters, our laboratory consists of PhD, MS, and undergraduate students who perform work in the field of aerosol measurement and control. Dr. Peters is an assistant professor of Industrial Hygiene at The University of Iowa, Department of Occupational and Environmental Health. He holds a bachelor's and master's degree in environmental engineering from the University of Florida, and a Ph.D. from The University of North Carolina at Chapel Hill.

Extent of Your Companies Involvement

We would propose to visit your company for a week of sampling. Your company may pick and choose from the following options:

1. ***Measure area concentrations by mapping particle concentrations with real-time monitors.*** We would do this four times during the week. We have a mobile sampling cart that we push through the plant. This sampling does not involve any personnel.
2. ***Measure personal exposure in real-time and over 8-hr shifts.*** We would have four workers wear backpacks with real-time monitoring equipment and filter samplers for three or for work shifts.
3. ***Measure personal exposure with passive samplers.*** We would have up to 20 workers wear passive samplers (like radiation dosimeters) that have no sampling pumps and are approximately the size of a thumb. These samplers would clip onto a persons lapel. We would have the workers wear them while they are at work and place them into a case at night. These samplers would be deployed for approximately one month and then be sent back to The University of Iowa for analysis.

Benefits to your company

1. Free industrial hygiene survey using new sampling methods that are not yet commercially available;
2. Relationship with The University of Iowa Industrial Hygiene program that would help advise your company with ventilation and control of your processes;

Our primary purpose is to evaluate our novel sampling methods in real-world environments. Your company will NEVER EVER be identified, unless you wish to be acknowledged for helping our research.

Recent Publication on Assessing Exposures:

Peters, T.M., Elzey, S., Johnson, R., Park, H., Grassian, V. H., Maher, T., O'Shaughnessy, P., Airborne monitoring to distinguish engineered nanomaterials from incidental particles for environmental health and safety. J Occup Environ Hyg, 2009. 6(2): p. 73-81.

Summarized on Following Page

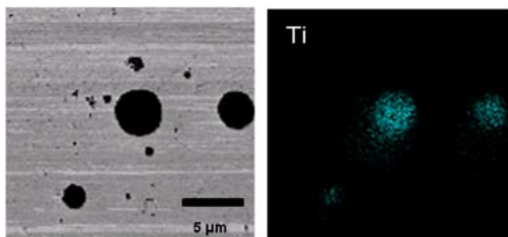


Fig. 1. TEM image at left; X-ray map at right. Only the large circular particles contain titanium.

Distinguishing Incidental from Engineered Particles.

Filter-based Sampling with Advanced Single-Particle Analysis by Electron Microscopy

Dr. Peters collaborated with [Vicki Grassian's research group](#) to characterize airborne nanoparticle exposure hazards in a company that makes lithium titanate particles for rechargeable batteries. Filter-based sampling was used to collect samples.

Two types of particles were identified in transmission electron microscope (TEM) images (Fig. 1, left): spheres; and chain agglomerates. The spheres contained titanium, hence the lithium titanate product produced in this facility, through X-ray mapping with energy dispersive spectrometry (EDS, Fig. 1, right). Chain agglomerates contained elements characteristic of welding fume (Fig. 2).

These findings allowed us to conclude that the engineered particles were substantially larger than nanosize. Further images from scanning electron microscopy (SEM) revealed that the morphology of these particles do have nanostructure (Fig. 3).

Activity-based Monitoring

We reached similar conclusions with activity-based monitoring. This monitoring involves matching real-time peaks in airborne concentrations with activities that are on-going in the facility (right).

Our results should have implications for monitoring airborne particles in work environments.

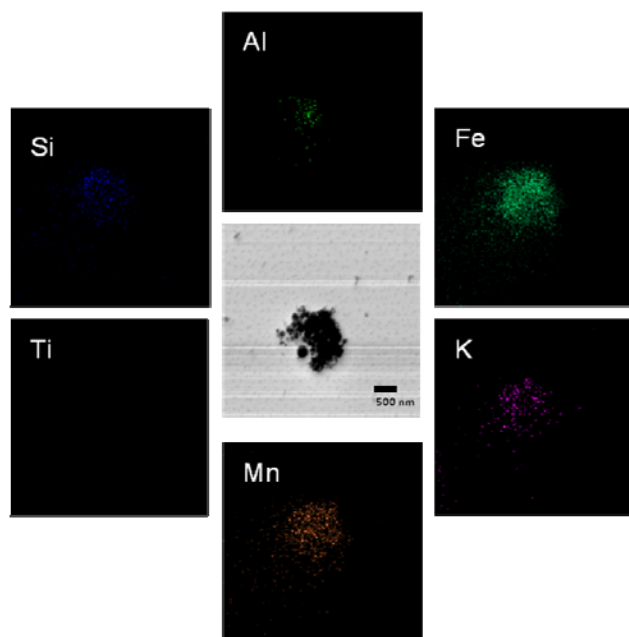


Fig. 2. TEM image of chain agglomerate in the middle frame with X-ray maps around. No titanium but evidence of elements common to welding fumes (e.g. Mn) are present.

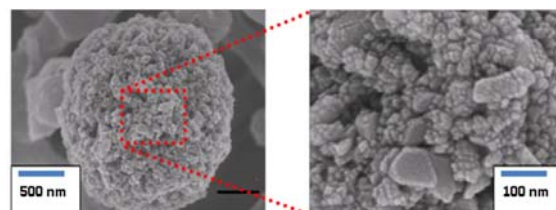
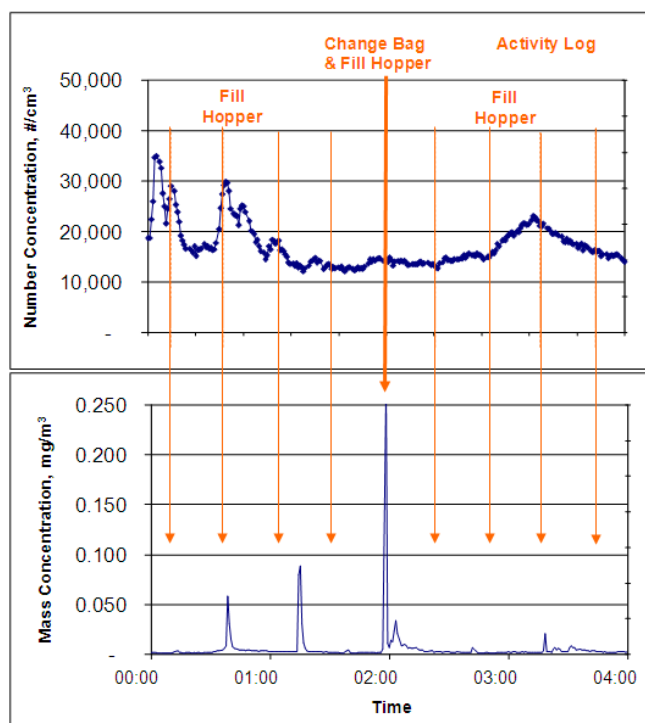


Fig. 3. SEM images show that spheres composed of fused nanoparticles ranging from 10-80 nm in size.



For Full Description See :

Peters, T.M. et al. Airborne monitoring to distinguish engineered nanomaterials from incidental particles for environmental health and safety. *J Occup Environ Hyg*, 2009. 6(2): p. 73-81.