

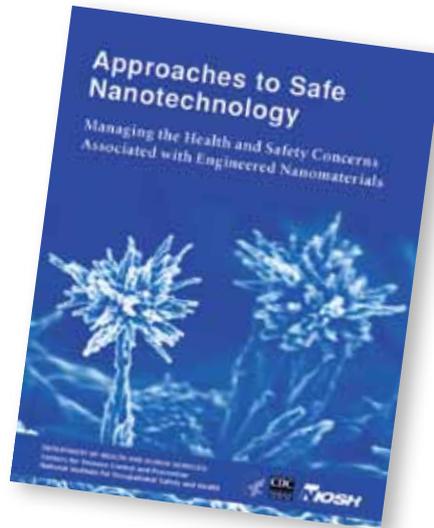
NIOSH research and resources for safe handling of nanomaterials

By Adrienne C. Eastlake

The mission of the National Institute for Occupational Safety and Health (NIOSH), a nonregulatory federal agency, is to conduct research and make recommendations for preventing work-related injuries, illnesses, and deaths. Within NIOSH, the Nanotechnology Research Center coordinates a program of laboratory and field investigations to develop and disseminate information on tools, practices, and recommendations for safe handling of nanomaterials in the workplace. Publications such as “Approaches to Safe Nanotechnology,” and others are available on the NIOSH website (see online resources in Table 1).

The possible health risks associated with exposure to these types of materials are not clearly understood. Research shows that traditional engineering control methods adequately decrease the potential for employee exposure to engineered nanoparticles. Until more is known, using nanoscale ceramics to create exciting new properties and opportunities for new products should be done in a way that limits worker exposure.

A look at metrics collected by organizations that follow nanotechnology industries provides some perspective. In 2013 the Nanowerk (Honolulu, Hawaii) nanomaterials database listed more than 3,000 commercially available pure nanomaterials. Another group, the Project on Emerging Nanotechnologies (Washington, D.C.) estimates that new nanotechnology-based consumer products are coming on the market at a rate



of more than four per week, according to the latest update to its nanotechnology consumer product inventory list. Finally, the market forecasting company BCC Research (Wellesley, Mass.) projects use of nanoscale ceramic powder in the United States will increase by a compound annual growth rate of 9.9 percent between 2011 and 2016. This type of market information validates the growing use of nanomaterials, including ceramic nanoparticles, in manufacturing processes and in a wide variety of consumer, industrial, and commercial products.

Workers in nanotechnology-related industries who are handling free, unbound nanoparticles risk potential exposure to these uniquely engineered materials at levels that far exceed the potential exposure of consumers, who may come into contact only with the bound materials.

Any inhaled free, unbound nanoparticles can lodge in the smallest, deepest areas of the lungs. Research with laboratory animals showed that some types of nanoparticles may cause inflammation and fibrosis in the lung, while some can penetrate the lung and move to other body organs. The significance of the translocation of these nanoparticles is not yet known and is the

subject of further research.

For example, a March 11, 2013, post in the *NIOSH Science Blog* reports that preliminary studies of animals show that certain types of multiwalled carbon nanotubes can act in concert with other known carcinogens to increase significantly the potential for tumor formation.

A NIOSH field studies team conducts onsite assessments of potential occupational exposure to a variety of nanomaterials and evaluates methods for mitigating exposure. The team partners with volunteer companies that produce or use engineered nanomaterials to expand and share knowledge specific to the health and safety practices needed for nanomaterials.

Partnering with NIOSH benefits the company by providing a comprehensive occupational exposure characterization and control technology assessment, at no cost to the facility. Current federal laws provide protection for the proprietary and trade secret information of the participating companies.

Visit the NIOSH Nanotechnology website listed in the table for information and guidance on handling engineered nanomaterials and partnering with the NIOSH nanotechnology field team.

Disclaimer

The findings and conclusions in this report are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

About the author

Adrienne C. Eastlake is an industrial hygienist with NIOSH. Contact: aeastlake@cdc.gov. ■

Table 1. NIOSH nanotechnology resources online

National Institute for Occupational Safety and Health (NIOSH)	www.cdc.gov/niosh
NIOSH Nanotechnology Topics	www.cdc.gov/niosh/topics/nanotech
NIOSH Publications and Products	www.cdc.gov/niosh/docs/2009-125
NIOSH Science Blog	www.blogs.cdc.gov/niosh-science-blog
Approaches to Safe Nanotechnology (pdf)	www.cdc.gov/niosh/docs/2009-125/pdfs/2009-125.pdf

contents

August 2013 • Vol. 92 No. 6

feature articles

Piezotronics: A new field of strain-engineered functional semiconductor devices 18

Xudong Wang

Semiconductors with piezoelectric properties show promise for LED quantum efficiency, quantum well lasers, electromechanical memory diodes, photocatalysts, and PV devices.

State of raw materials 2013: Overview and new frontiers 24

Eileen De Guire

ACerS's annual report on critical raw materials and a summary of the USGS minerals report.

Expanding the frontier—Grand challenges in ceramic science 29

Gregory S. Rohrer

Fifteen years after the last "grand challenges" workshop, a group of researchers identifies eight new grand challenges for ceramic science in the next decade.

NIOSH research and resources for safe handling of nanomaterials 32

Edited by Adrienne C. Eastlake

A look at the possible worker health and safety risks associated with nanomaterials, and at ways to minimize them.

Honoring the ACerS Awards class of 2013 33

Distinguished Life Member Awards 33

2013 Class of Fellows 34

Society Awards 38

Class Awards 39

meetings

Materials Science & Technology 2013 42

Lectures and special events 42

Plenary session 43

Calendar of events 44

Program-at-a-glance 45

ACerS short courses 47

AACS Division Workshop: Using X-rays to analyze cultural heritage 48

UNITECR 2013 49

Welcome reception, schedule at a glance 49

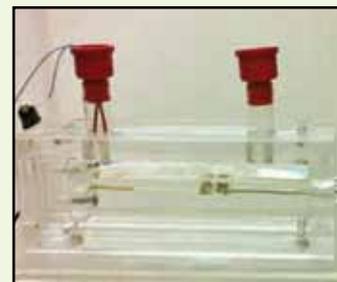
Hotel information 49

Conference dinner, poster session, sponsors, short courses, optional tours 50

departments

News & Trends 3

- New projects worth millions announced on Materials Genome Initiative second anniversary
- Shale gas a 'blue bridge to a green future'?
- Business news
- Coming soon: NSF career development workshop for young academics
- New ACerS website speedy, easy, and ready for smartphones and tablets
- Good news for ACerS journals



cover story

Piezotronics: A new field of strain-engineered functional semiconductor devices

(Credit: Wang; U. Wisc-Madison)

– page 18



**State of raw materials 2013
Overview and new frontiers**

(Credit: iStock)

– page 24



Honoring the ACerS Awards Class of 2013

(Credit: ACerS)

– page 33