



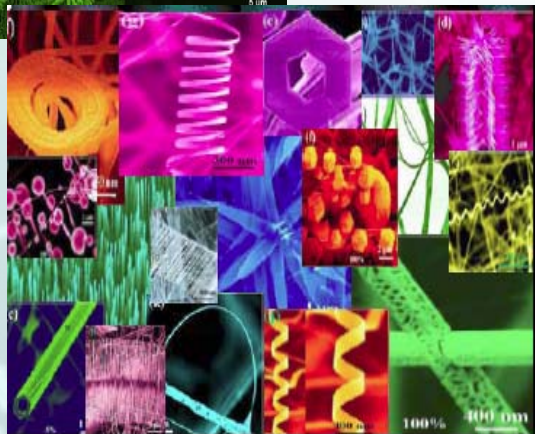
Chemical Information Call-in Candidate: Nano Zinc Oxide

Shenglan Zhang and Hamid Saebfar
California Department of Toxic Substances Control

September 22, 2010
San Francisco, California

OVERVIEW:

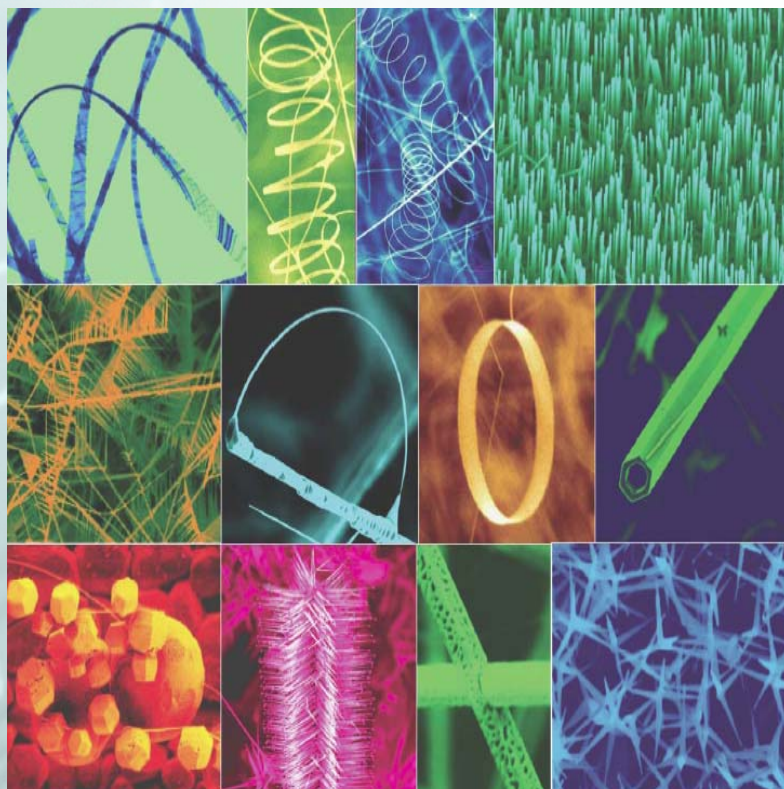
Nano Zinc Oxide (ZnO)



Photos: Dr. Z Wang, Georgia Tech

- **Why?**
 - Diverse Nanostructures
 - Broad Potential Applications
 - Multiple Consumer Products
 - Limited Chemical Information
- **What Information Gaps?**
 - Analytical Procedures
 - Characterization, Identification, Detection, Monitoring
 - Human Health and Environment
 - Fate and Transport
 - Hazards and Exposure
 - Risk Management
 - Safety and Handling
- **Who?**
 - Producers
 - Importers/Distributors
 - Researchers

Diversity of Nano ZnO Nanostructures



- Nanobelts
- Nanohelices
- Nanocages
- Nanorods
- Nanoflowers
- Nanospheres
- Nanocombs
- Nanorings
- Nanowires
- Nanosheets

Provided by Zhonglin Wang, Materialstoday June 2004

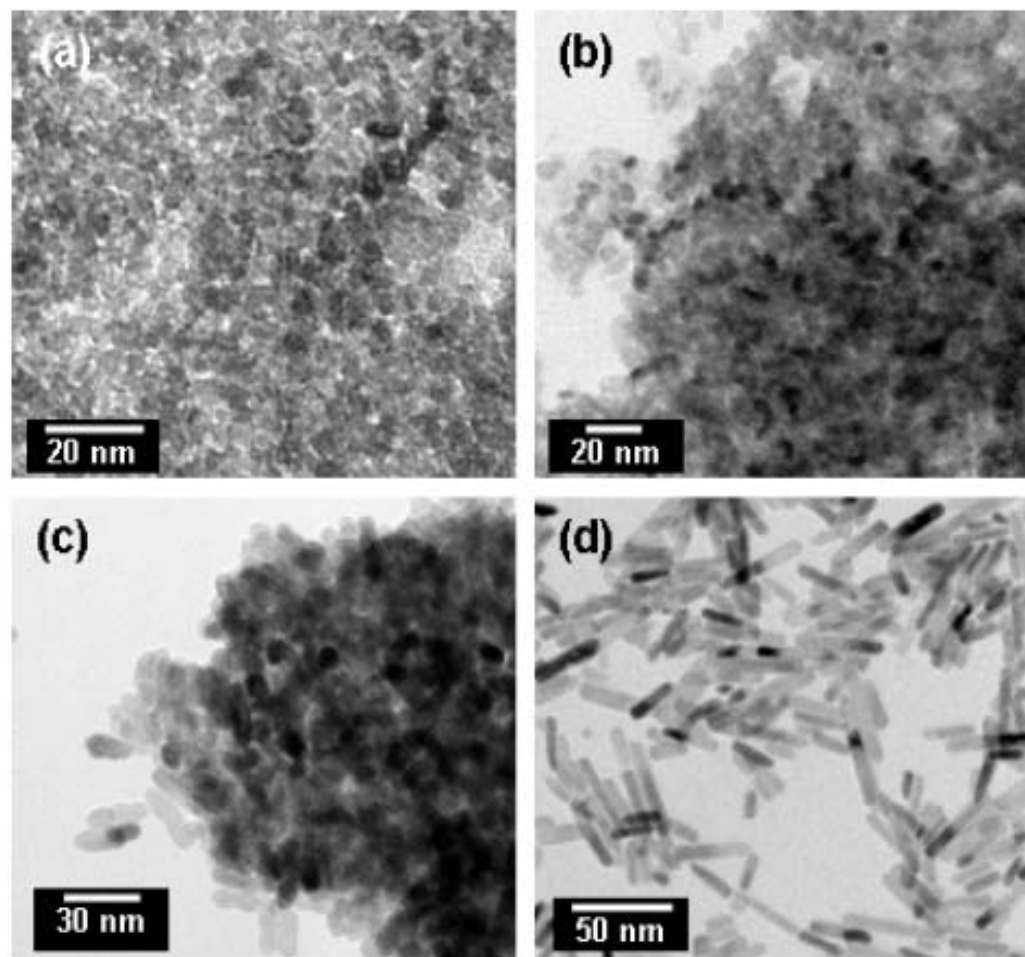


Figure 2. TEM images of ZnO nanostructures grown without (a) evaporation and with evaporation to (b) 50, (c) 20 and (d) 10% of its original solvent volume.

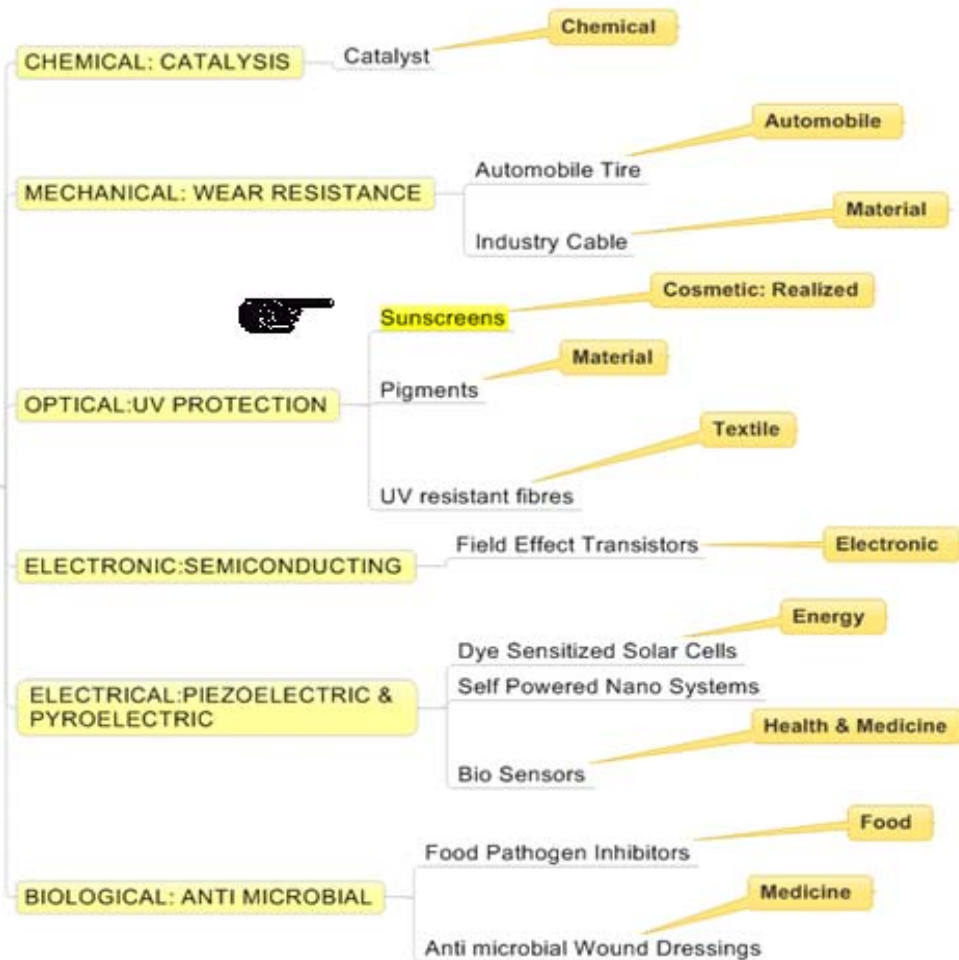
Diversity of Nano ZnO Applications



Nano Zinc Oxide powder used in sunscreen (BASF).

Functionality & Application

Nano ZnO Worldwide Production:
528 tons per year



Nano Zinc Oxide Manufacturers

CALIFORNIA

- Universities
 - UC San Diego
 - UC Berkeley
 - USC
- Ferity Zinc Oxide Inc.
- APF Laboratories
- Atomate Corporation
- Stanford Materials
- Alpha Environmental

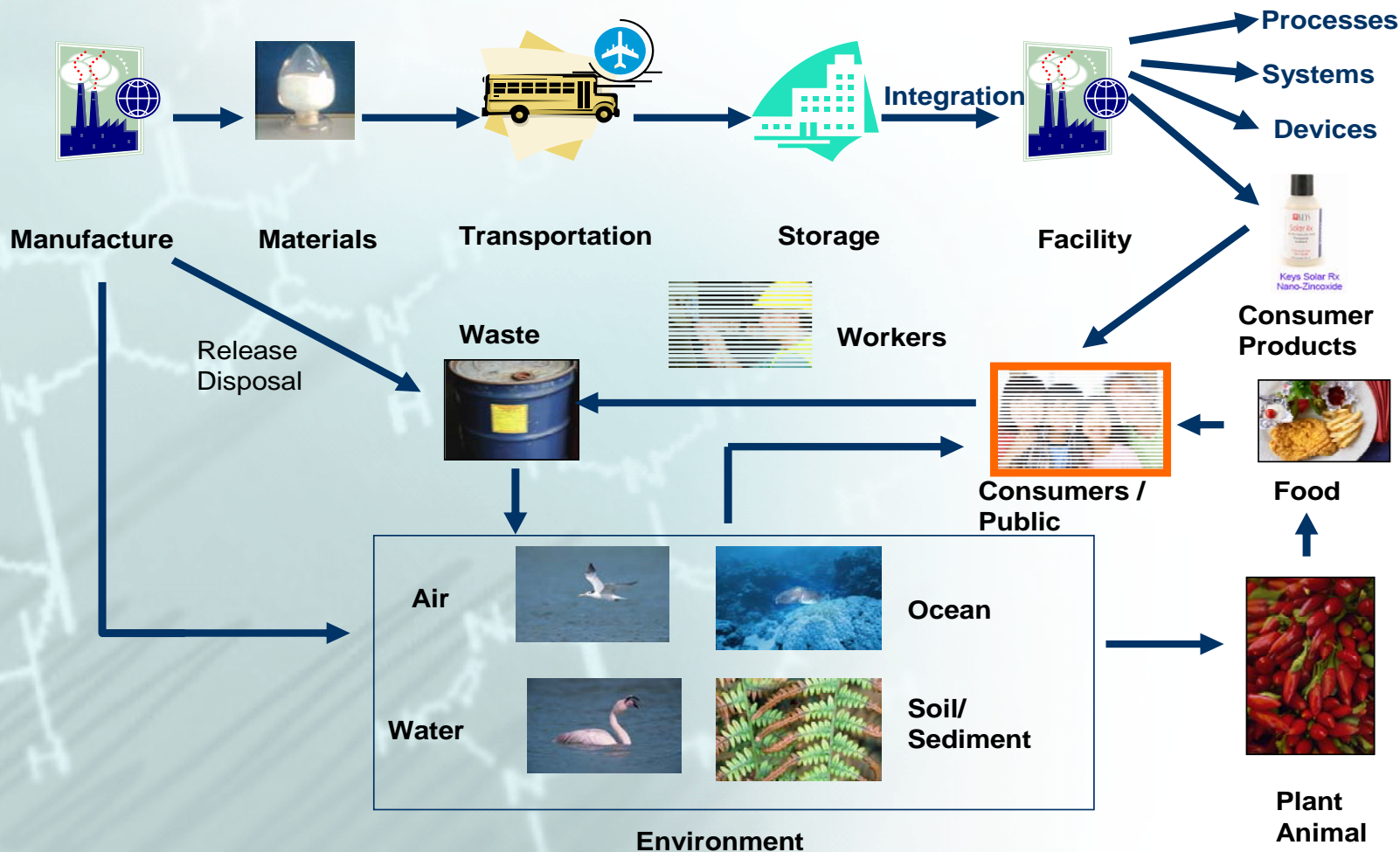
OUTSIDE CALIFORNIA

- Nanophase Technologies
- Sokang Nano
- Antaria Corporation
- Ocean Nano Tech
- LaamScience
- Advanced Nanotechnology
- NanoGate
- Inframat Advanced Materials
- Reade Advanced Materials
- KIA
- Nanjing High Tech Nano Material Co., Ltd
- Mknano
- Sincown Industrial Co.,Ltd
- Nanozinc oxide South Africa
- NanoMaterials Technology
- UmiCore Group
- Horsehead Corporation

Nano ZnO Toxicity Studies

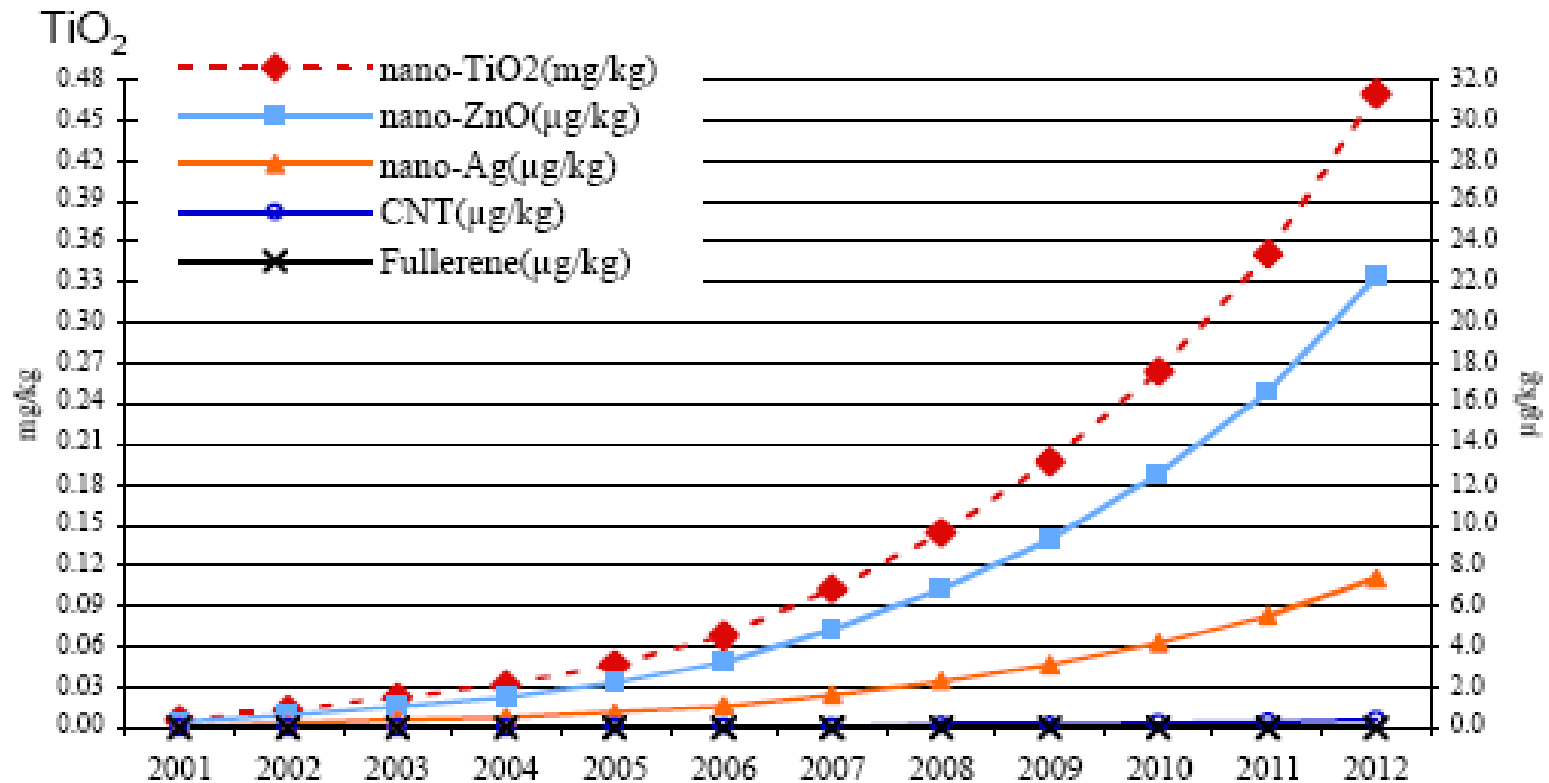
<i>Target</i>	<i>Result</i>	<i>Mechanism</i>	<i>Reference</i>
Zebrafish embryo	Reduced hatching rate and caused pericardial edema.	Increased ROS and compromised cellular oxidative stress	Zhu, et al. Nanotechnol., 2009
<i>Lolium Perenne</i>	Biomass was greatly reduced, root tips shrank	Phytotoxicity was caused by physical and chemical interference.	Lin and Xing, Environ. Sci. Technol., 2008
Human Lung Epithelial Cells	Nano-ZnO led to dose and time dependent cytotoxicity	Caused oxidative stress, lipid peroxidation, cell membrane damage and DNA damage	Lin, et al. J. Nanopart. Res., 2009
Crustaceans, Bacteria, Algae, Fish, Ciliates, Nematodes, Yeasts	Nano-ZnO was classified as "extremely toxic"	Toxicity was due to their solubilization	Kahru and Dubourguier, Toxicology, 2009
<i>Vibrio fischeri</i> , <i>Daphnia magna</i> and <i>Thamnocephalus platyurus</i>	Nano-ZnO particles do not necessarily have to enter the cells to cause toxicity	Nano-ZnO increased the solubility of metals and generate ROS	Heinlaan, et al. Chemosphere, 2007

Nano Zinc Oxide Lifecycle



Nano Zinc Oxide Concentrations in Sludge Treated Soil

In EU from 2001 through 2012



Sample Questions for Chemical Information Call-in

Producers and Researchers

- Describe specifically the nanostructure, functionalities, and properties (physical, chemical, and biological) of nano zinc oxide material that is produced in the facility.
- Describe the in-house instrument and analytical methods you use to determine the presence of nano zinc oxide in the workplace and environment.

Importers and Distributors

- Describe the chemical information provided by external vendors relative to nano zinc oxide nanostructure, functionalities, and properties.
- Describe the instrumentation and analytical methods used by external laboratories that provided the above chemical information.



Please participate!

*Browse our website, offer comments,
prepare and submit your responses,
meet with us, and call and write!*

Please contact:

Shenglan Zhang, Ph.D
(760)457-9453
szhang@dtsc.ca.gov

Hamid Saebfar
(818)717-6530
hsaebfar@dtsc.ca.gov