

nanophase technologies corporation
INNOVATE. PERFORM. SUCCEED.

Nanotechnology: Enabling Success in Energy A Materials Perspective

Jess Jankowski, Nanophase Technologies Corporation
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The forward-looking statements contained herein are made only as of the date of this presentation, and Nanophase Technologies undertakes no obligation to publicly update such forward-looking statements to reflect subsequent events or circumstances.



Corporate Information

Nanophase Technologies Corp.

Corporate Headquarters:

1319 Marquette Drive

Romeoville, IL 60446

630.771.6700

Second manufacturing facility in Burr Ridge, IL

www.nanophase.com

Ownership: Public since 1997

NASDAQ: NANX

Fiscal Year: December 31

Common Stock: 21.2 million shares outstanding

Nanophase Technologies Corporation

- First, large scale, commercial manufacturer of Nano metal oxide powders
 - Metric Ton production
 - 6 σ , ISO 9001:2000, ISO 14000:2004, cGMP
- First Nano company to provide highly concentrated Nano dispersions
- Leading industry transformation from technology push of Nano platform to customer-driven Nano solutions
- Dominant position in Nano ZnO for Personal Care market, >95% market share
- Leader in developing EH&S standards for nanomaterials

History – Leading Nanotechnology Growth

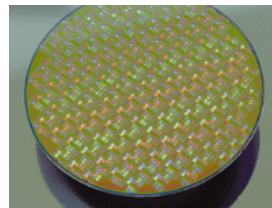
- **1989** – Spun out of Argonne National Laboratory
- **1995** – Launched 1st manufacturing process → Physical Vapor Synthesis (PVS)
- **1997** – IPO (NASDAQ: NANX)
- **2001** – Launched 2nd manufacturing process → Nano Arc Synthesis (NAS)
- **2002** – Commercialized dispersion and surface treatment capabilities
- **2003** – BASF commercialization of ZnO in Personal Care market
- **2004+** Significant Nano adoption



Nano materials in the Marketplace



Congoleum



Markets

- Personal Care
- Exterior Coatings
- Hard Surfaces
- Architectural Windows
- Electronics
- Animal Hygiene
- Textiles
- Plastics
- Energy

Nano Technology

Teat dip technology enters the 21st century

NANODIP and NANOSPRAY are the first teat dips in the world to utilise revolutionary Nanotechnology.



Nanotechnology Maturation Process

The approach to Nanotechnology has shifted from exuberance over the potential to focus on realizing commercial value

Time Period	Business Model	Technical Expertise	Organizational Focus
2004 to 2005	Selling nanomaterials	Making nanomaterials with specific characteristics	Research
2006 to 2008	Selling nano-intermediates such as dispersions and additives	Functionalizing and dispersing nanomaterials	Manufacturing, product development
2009 and beyond	Developing application specific solutions	Integrating nanomaterials into customers' formulations	Sales driven, market focused

Adapted from: Lux Research Report Q32008

Nanotechnology and Energy – since 2000

- 210 doctoral theses
- 5880 patents or patent applications
- 93,731 scientific journal articles
- 22,300,00 Google hits!



Nanotechnology and Energy

Where to begin????

Renewable Energy

Heat transfer

Fuel cells

Hydrogen storage

Solar Films

Solar Photovoltaics

Supercapacitors

Sensors

LEDs

Batteries

Boiling with Refrigerants and Nanolubricants

Mark A. Kedzierski
National Institute of Standards and Technology
Gaithersburg, Maryland

NIST



Energy Storage



NanoArc®

Nanophase develops liquid and solid nanoparticle dispersions optimized for compatibility in your battery technology platforms.

Zinc Oxide Aluminum Oxide Cerium Oxide
Titanium Dioxide Bismuth Oxide



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Begin With the End in Mind...Success!

The probability for success in any nano-enabled energy application can be dramatically improved using the five “C” formula:

- Consistency
- Colloidal Stability
- Congruence
- Compatibility
- Cost



Consistency

Many nano-enabled energy applications will be extremely sensitive to material quality...

- Purity
- Reproducibility
- Particle size / surface area
- Particle size distribution
- Concentration



Colloidal Stability

Energy applications will require nanomaterials to be delivered in a pre-dispersed format...

- Individual, primary particles (or CNT, fibers, etc.)
- High solids
- Manageable viscosities
- Commercially useful shelf life



Congruence with Existing Platforms

- “I want a drop-in solution!!!!”
 - voice of the customer



- The product format must be familiar/easy-to-use/safe
- Product must conform to existing platforms, infrastructure and industry norms

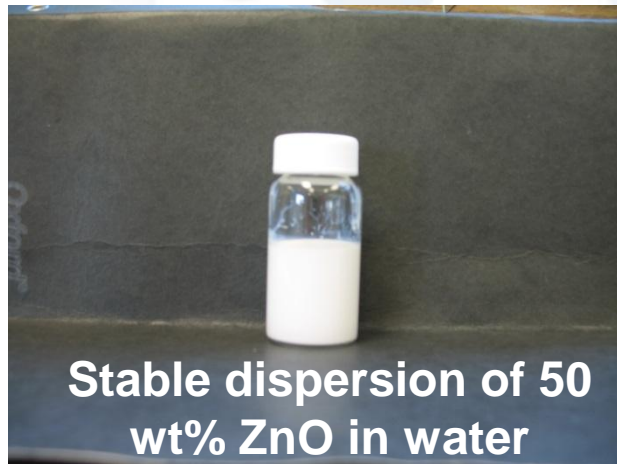
Compatibility

In addition to colloidal stability (nanoproduct), the nanomaterial must remain “nano” when added to the energy system (battery, thermal fluid, self-cleaning window, etc.)...

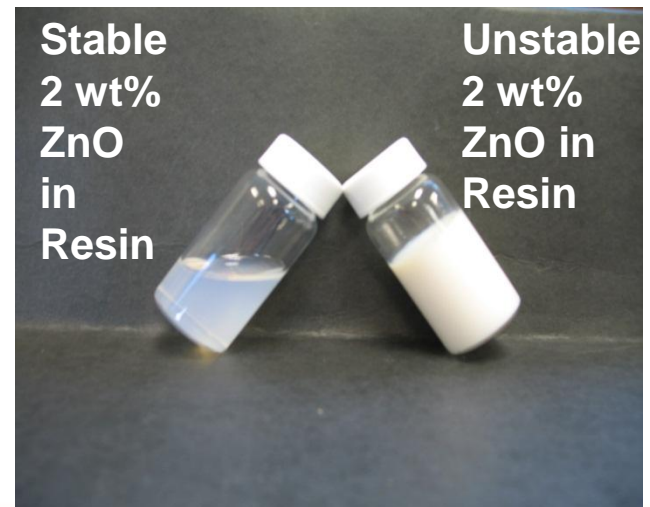
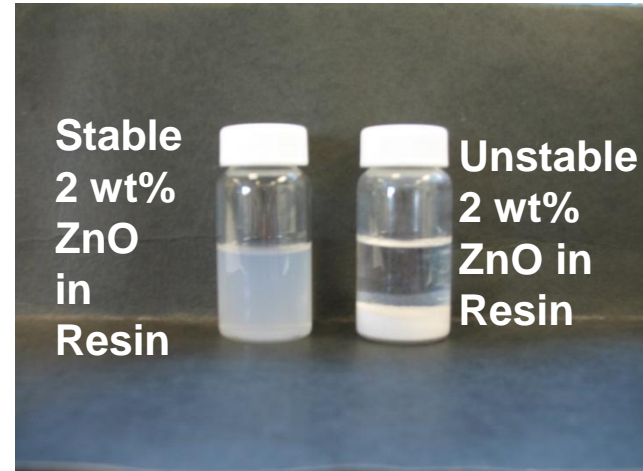
- Chemical compatibility
- Physical stability
- Reactivity
- Maintain activity



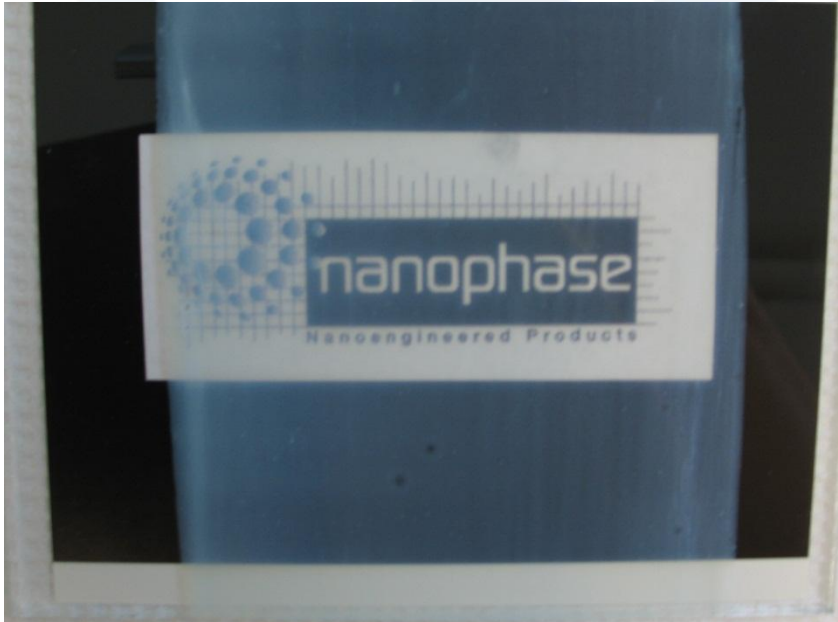
Example: Nano ZnO Dispersion Must Be Compatible With A Particular Resin



Add to resin



Example: Compatibility and the Impact on Transparency



Incompatible
1wt% ZnO in Clear
Coating, 1 mil



Compatible
1wt% ZnO in Clear
Coating, 1 mil

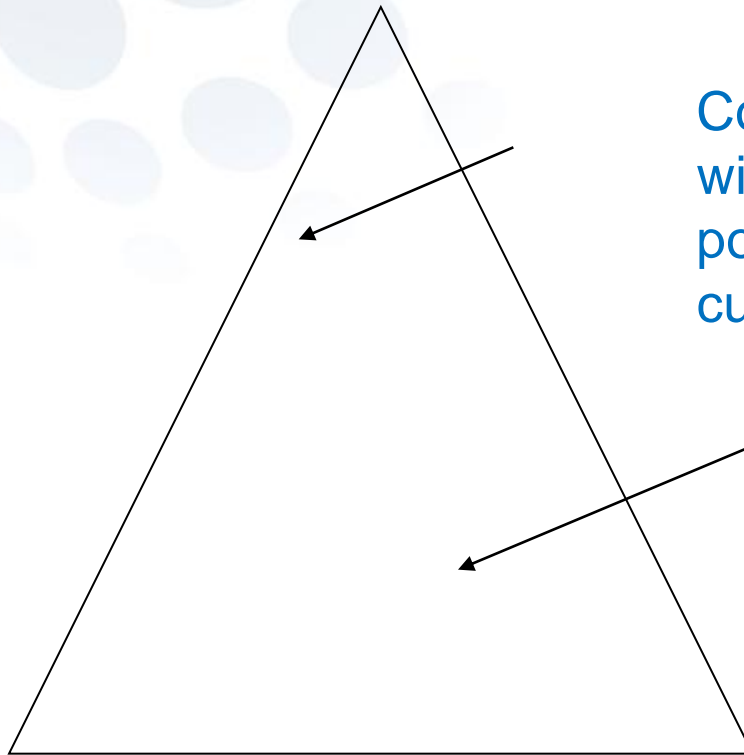
Cost

PERFORMANCE

Discuss
Upfront!



COST



Commercially viable solution
will likely optimize at a different
point for every
customer...

NANO "ATTRIBUTE"

Summary

- Nanotechnology has not even come close to realizing its full potential in energy!
- Nanotechnology is rarely a drop-in solution
- Application focus and knowledge must be a priority
- Compatibility/format must be engineered for a given system
- Cost performance optimization must be done to ensure commercial success

***Step-change performance with
Nanotechnology leads to commercial success!***

Thank You!

Questions ?????

Additional Company and Product Information

www.nanophase.com