ADVANCED MATERIALS
NIOSH PERSPECTIVE

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TECHNOLOGIES THAT IMPACT THE WORKPLACE

- Nanotechnology
- Advanced Materials
- Biotechnology
- Additive Manufacturing/3D Printing
- Digitalization and advanced computing
- Artificial Intelligence, Machine Learning (VR, AR)
- Sensing Technology
- Modeling and Simulation
- Robotics

Drawn from several forecasting reports.
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ADVANCED MATERIALS

- Materials designed with a specific functionality or application in mind
- Generally more active
- Impart new or improved properties
- Functional textiles
- Biomaterials

Does more ‘active’ = higher hazard?
Examples of Advanced Materials

Metal Organic Frameworks (MOF)

- Cage like structures
- Large internal and external surface area
- Reactive
- Manufactured as fine powders
- Formed into solids for applications

Applications
- 3D Printing ‘ink’
- Gas storage
- Drug delivery
- Sensors
- Nutrient detection and delivery
Examples of Advanced Materials

The quest for a better Li Ion battery through more efficient electrode materials

Carbon/LiFePO4 material research. “Reducing the size of the particles to create morphologies which could provide a path for better ion diffusion’

If manufactured and processed in high volumes, would this material require special handling?

Caban-Huertas, Scientific Reports, 2016
Applying Current EHS Knowledge

Nanotechnology

Advanced Materials

Advanced Manufacturing
ADVANCED MATERIALS IN MANUFACTURING

Additive Manufacturing
3D Printing
Functional Fabrics
Photonics
Flexible Sensors
Light Weighting
Advanced Composites
Clean Energy
Robotics
Engineered Biology

Advanced Manufacturing

Some processes and some products.
Additive Manufacturing and 3D Printing
Old & New Processes and Materials

Old Processes:
- Welding
- Curing
- Printing

New Processes:
- Controlled
- Combined
- Automated

Old Materials:
- Metals & Alloys
- Thermoplastics
- Photopolymers
- Ceramics

New Materials:
- Superalloys
- Nano-additives

Hazards resemble those of past materials and processes, but in new combinations and contexts.
Bio-Based Manufacturing

Impact on Workers, Environment, and Consumers?

Synthetic Biology
- DNA Synthesis
- DNA Editing

New Organisms
New genetic material

Advanced Biotechnology
Manufacturing Processes

New Bio-based Products
Improved form of old products

‘Old’ products a new way
New products

Will using Biology as a manufacturing technology create unanticipated hazards for workers and consumers?

Can existing biosafety, chemical safety, and other frameworks be used to achieve safe biology-based manufacturing? If not, what do we need to develop?
NIOSH Nanotechnology Field Team

- Over 100 visits to 65 nanotechnology sites
- 19 visits to 11 additive manufacturing sites
- Use existing methods to evaluate processes & exposures
- Provide guidance and recommendations to partners
- Fill knowledge gaps on real-world technologies, uses, and exposures
- Always seeking more partnerships and collaborations!
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