

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 Material
Component

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ADVANCED MATERIALS

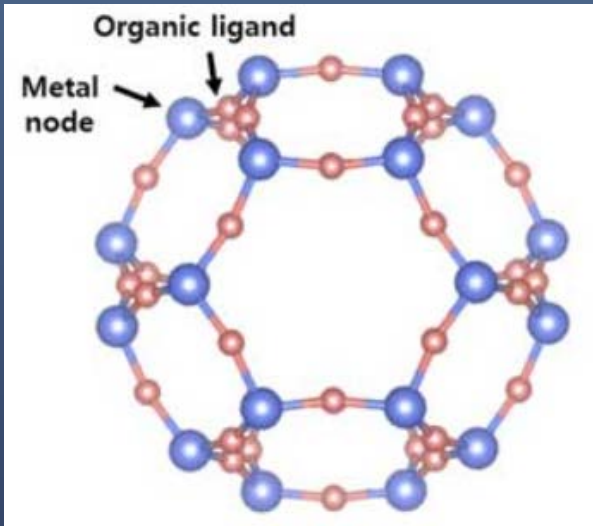
- ▶ Materials designed with a specific functionality or application in mind
- ▶ Generally more active
- ▶ Impart new or improved properties
- ▶ Functional textiles
- ▶ Biomaterials

Does more 'active' = higher hazard?



Examples of Advanced Materials

Metal Organic Frameworks (MOF)



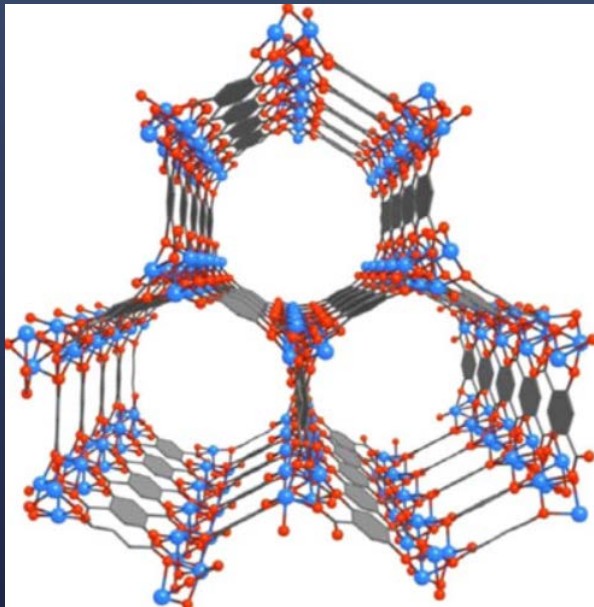
Cage like structures

Large internal and external surface area

Reactive

Manufactured as fine powders

Formed into solids for applications



Applications

3D Printing 'ink'

Gas storage

Drug delivery

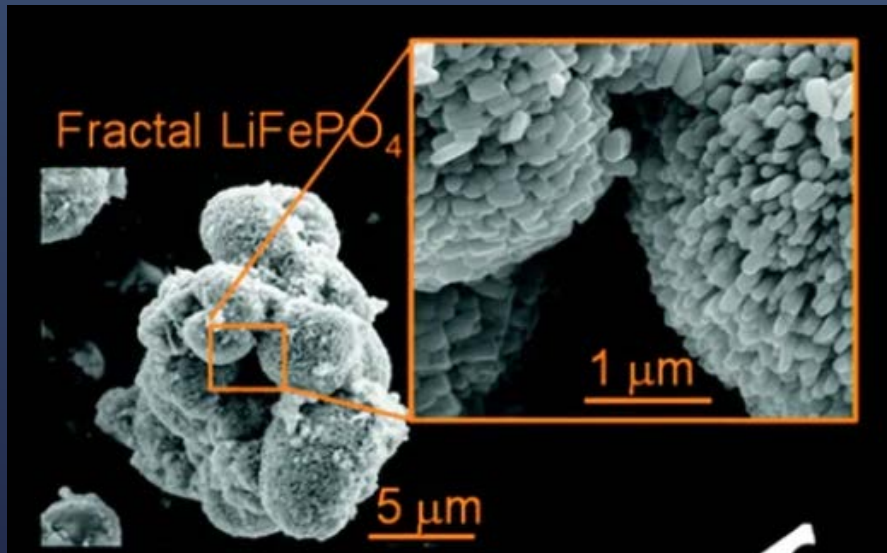
Sensors

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”



Caban-Huertas, Scientific Reports, 2016

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

Applying Current EHS Knowledge



ADVANCED MATERIALS IN MANUFACTURING



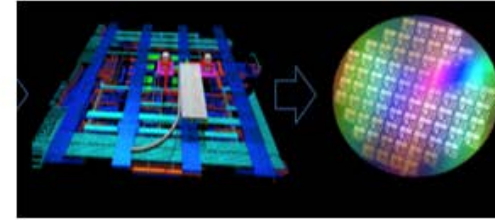
Additive Manufacturing



3D Printing



Functional Fabrics



Photonics



Flexible Sensors

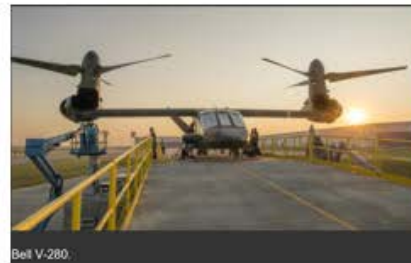
**Advanced
Manufacturing**



Robotics



Light Weighting



Advanced Composites



Clean Energy

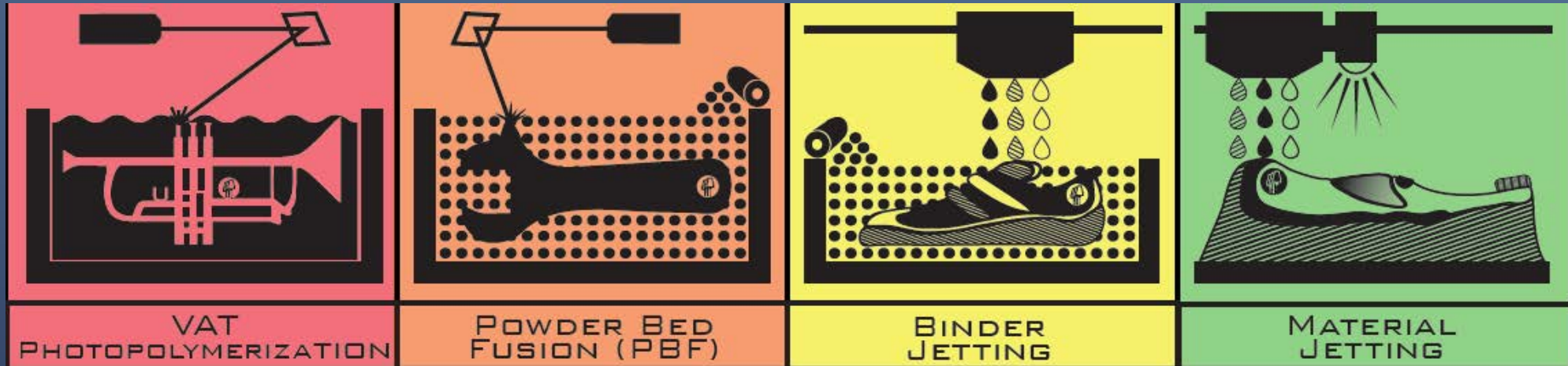


Engineered Biology

Some processes and some products.

Additive Manufacturing and 3D Printing

Old & New Processes and Materials

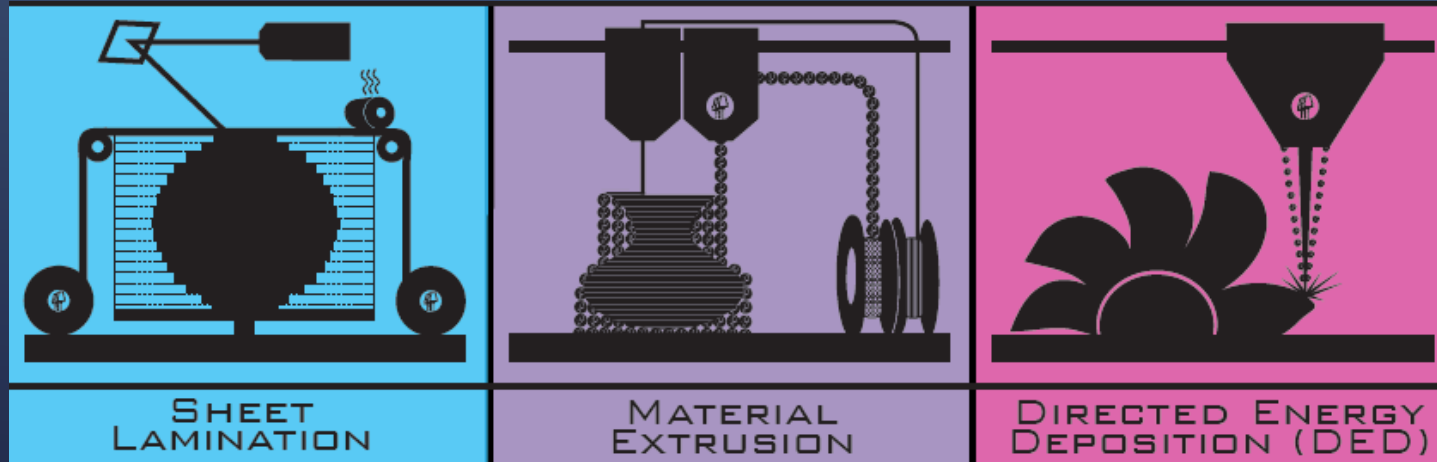


Old Processes:

- Welding
- Curing
- Printing

New Processes:

- Controlled
- Combined
- Automated



Old Materials:

- Metals & Alloys
- Thermoplastics
- Photopolymers
- Ceramics

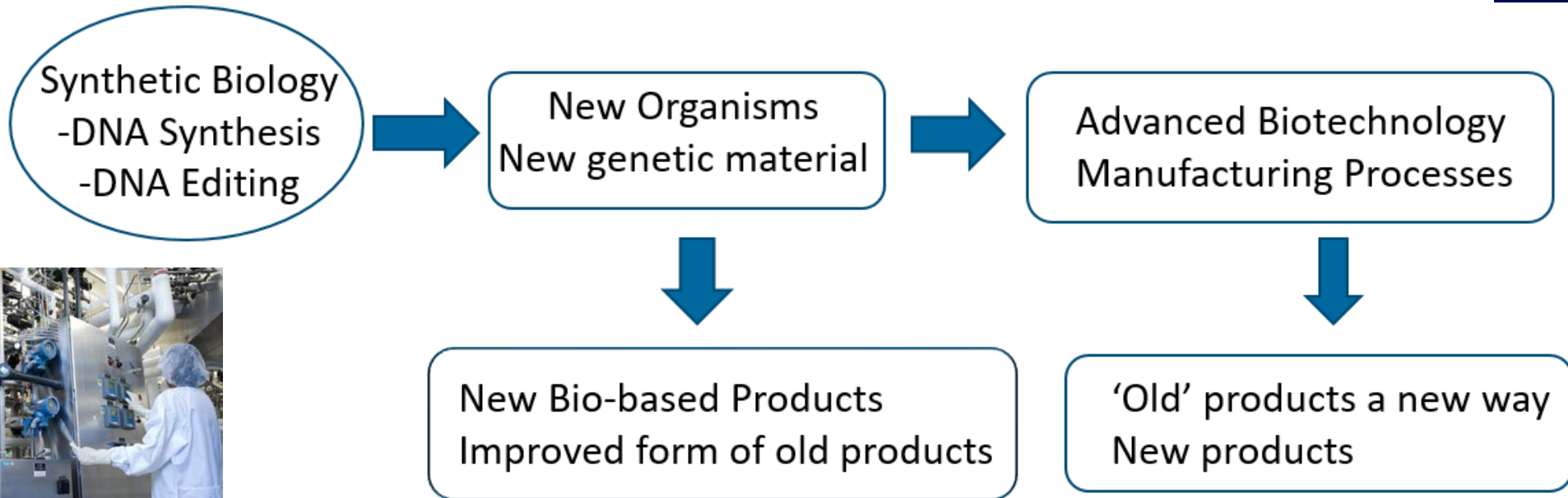
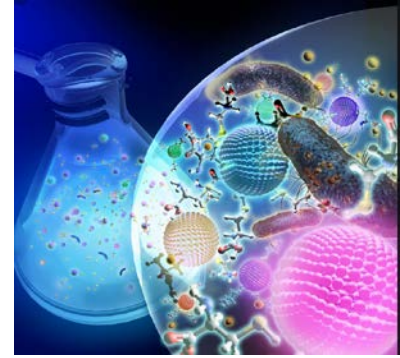
New Materials:

- 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?

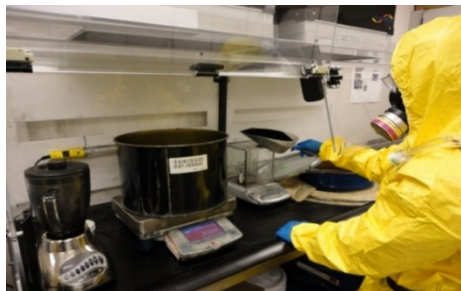


Will using Biology as a manufacturing technology create unanticipated hazards for workers and consumers?

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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