

Reading 3

Skills:

- Details
- Make associations
- Understand synonyms

Getting started: Do you know what nanotechnology is? Are you familiar with current applications of nanotechnology?

NANOTECHNOLOGY AND THE FUTURE OF MANUFACTURING



Nanotechnology involves the manipulation of matter on the atomic and molecular scale, structures between one and 100 nanometers in size, being a nanometer the equivalent of a one thousand-millionth of a meter. To put that into perspective, comparing a nanometer to a meter is like comparing the size of a marble to the size of the earth.

Nanomanufacturing focuses on the development of scalable processes for the commercial production of materials, structures, devices and systems at the nanoscale. Recently, it has been a growing area of research and development (R&D) for manufacturing applications. Engineers can synthesize nanomaterial in two ways, the first is by using the top down method, the process of carving nanomaterial out of something bigger. This is the most common method, often used to make computer

chips and other everyday items. The alternative is the bottom up method, the process of assembling a structure at the molecular level, one atom at a time. This method is still in the experimental stage of development and is time-consuming and complex.

Extensive R&D has led to significant advances in nanotechnology, some which could revolutionize manufacturing processes. Exploration into what can be achieved using the bottom down method has encouraged research into creating molecular components that can self-assemble into a specific structure without the need for external interaction. Three applications in particular reveal tangible evidence of what the future of manufacturing will look like.

Improving Safety

The integration of nanomaterial into layers has led to a great progression in safety wear and has become increasingly popular for biotextiles. When nanosized carbon particles are dispersed within the original fibers of the clothes, they create a covering of nanofibers. Using carbon nanofibers as a textile composite makes the clothes liquid repellent, stain resistant and even antimicrobial. In manufacturing, this safety wear can be used to protect workers in hazardous areas.

Fuel Efficiency

Polymer nanotechnology involves dispersing nanoparticles into an existing polymer's matrix to develop adhesives, sealants, coatings, and encapsulation compounds. Incorporating nanoparticle fillers to these applications has the potential to develop characteristics of thermal stability, water and chemical resistance, higher tensile strength and even flame resistance. Polymer nanocomposites have become an important addition to the automotive industry for tire manufacturing. The chemical and flame-resistant particles offer better performance at a lighter weight to traditional tires, subsequently offering higher fuel efficiency.

Reducing Friction

Introducing nanotechnology to the production of lubricants has unlocked the possibilities for more diverse solutions in manufacturing. In instances where oils are typically used to reduce the friction between two objects, nanoparticles can be used instead. These nanoparticles act like tiny ball connections, rolling between the two surfaces and reducing the opportunity for heat, wear and oil

failure. A diminishing supply of fossil fuels means this development could be revolutionary not just for the future of manufacturing, but for the environment too.

Nanometers may be the size of a marble when compared with the earth, but that doesn't diminish the significance of nanotechnology. With further research dedicated to the progression of nanomaterials, there's a bright future for more industries to incorporate nanotechnology into their day-to-day procedures.

**Adapted from <https://www.automation.com/en-us/articles/2019/nanotechnology-and-the-future-of-manufacturing>*

Answer the following questions:

1. What kind of processes these descriptions have to do with? Write Top down method or bottom up method.
 - a. A machine compacts a series of atoms to produce a chip. _____
 - b. Out of a piece of steel, a small particle is obtained. _____
2. What do the following statements refer to? Write **1** for safety, **2** for fuel efficiency or **3** for reducing friction.
 - a. Spilling coffee onto your shirt would not be a problem anymore.
 - b. Certain kind of fuels would not be necessary anymore.
 - c. Your car would not spend so much gasoline.
 - d. Nanotechnology can help reduce pollution.
 - e. A more efficient type of glue could be created thanks to nanotechnology.
 - f. A virus like the SARS-CoV-2 could not attach to your clothes.
3. Look at the words below. Find their synonyms in the text.
 - a. Include
 - b. Lately
 - c. Improvements
 - d. Inside
 - e. Significant
 - f. Chances

What do you think?

What's the benefit of using nanotechnology in our modern world?