

What is nanotechnology?

Since the 1990s, nanotechnology has evoked great interest among the scientists and the general public with its potential to bring about breakthroughs in material technology and applications. There is no doubt that it opens up a new enabling field for manipulation of matter at the atomic level which builds up structures with newer and non-intuitive properties. Nature, particularly the living world, has been a source of inspiration for development of nanotechnology in great measure as several biological phenomena have been understood in terms of unique arrangement of atoms as the structure builds up. The other driving force has been the semiconductor industry with its persistent quest for miniaturization and higher computing power. It is hard to provide exclusive definition of nanotechnology. This domain can be described as designing of matter with building blocks of few nanometers (< 50nm in at least one of the dimensions), yielding a new set of properties significantly different from the bulk.

The concept of nanomaterials rests on two characteristics:

Firstly, the size of the basic structural unit should be only a few atoms large. The size criterion needs to be satisfied along one of the three dimensions. This leads to three different types of nanophases.

- Zero dimension: Nanoparticles, nanopores
- One dimension: Nanorods, nanowires, nanotubes
- Two dimensions: Nanofilms, nanosheets, nanolayers

Secondly, the properties of the nanophase materials have to be distinctly different compared to the bulk material. This is a prerequisite for nanomaterials. Mere extrapolation of properties, as the particle size decreases into the nanometer region, is not enough for the material to be termed as nanomaterial. The qualitative and quantitative change of behavior in nanophase substances is the very foundation on which science of nanotechnology is based and offers opportunities for novel applications.

This raises an obvious question about the nature of cause-and-effect relationship between the nanometer size and the novelty of the properties. This is dealt with in this compilation in the form of questions and answers.
