علم النانو في الفيزياء الطبية

Nanoscience in Medical Physics

CHAPTER TWO

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History and Future of Nanomaterials

The Lycurgus Cup is a 4th-century Roman glass cage cup made of a dichroic glass, which shows a different colour depending on whether or not light is passing through it: red when lit from behind and green when lit from in front. 1It is the only complete Roman glass object made from this type of glass, and the one exhibiting the most impressive change in colour; it has been described as "the most spectacular glass of the period, fittingly decorated, which we know to have existed".

The cup is also a very rare example of a complete Roman cage-cup, or diatretum, where the glass has been painstakingly cut and ground back to leave only a decorative "cage" at the original surface-level. Many parts of the cage have been completely undercut. Most cage-cups have a cage with a geometric abstract design, but here there is a composition with figures, showing the mythical King Lycurgus, who (depending on the version) tried to kill Ambrosia, a follower of the god Dionysus (Bacchus to the Romans). She was transformed into a vine that twined around the enraged king and restrained him, eventually killing him. Dionysus and two followers are shown taunting the king. The cup is the "only well-preserved figural example" of a cage cup.

The dichroic effect is achieved by making the glass with tiny proportions of nanoparticles of gold and silver dispersed in colloidal form throughout the glass material. The process used remains unclear, and it is likely that it was not well understood or controlled by the makers, and was probably discovered by accidental "contamination" with minutely ground gold and silver dust. The glass-makers may not even have known that gold was involved, as the quantities involved are so tiny; they may have come from a small proportion of gold in any silver added (most Roman silver contains small proportions of gold), or from traces of gold or gold leaf left by accident in the workshop, as residue on tools, or from other work. The very few other surviving fragments of Roman dichroic glass vary considerably in their two colours.

Almost 15 years after Feynman's lecture, a Japanese scientist, Norio Taniguchi, was the first to use "nanotechnology" to describe semiconductor processes that has been occurred on the order of a nanometer. He mentioned that nanotechnology consisted of the processing, separation, consolidation, and deformation of materials by one atom or one molecule. The golden era of nanotechnology began in the 1980s when Kroto, Smalley, and Curl discovered fullerenes and Eric Drexler of Massachusetts Institute of Technology (MIT) used ideas from Feynman's "There is Plenty of Room at the Bottom" and Taniguchi's term nanotechnology in his 1986 book titled, "Engines of Creation: The Coming Era of Nanotechnology." Drexler proposed the idea of a nanoscale "assembler". Drexler's vision of nanotechnology is also called "molecular nanotechnology." The science of nanotechnology was advanced further when Iijima, another Japanese scientist, developed carbon nanotubes.

The beginning of the 21st century saw an increased interest in the emerging fields of nanoscience and nanotechnology. In the United States, Feynman's stature and

his concept of manipulation of matter at the atomic level played an important role in shaping national science priorities. President Bill Clinton advocated for funding of research in this emerging technology during a speech at Caltech on January 21, 2000. later, President George W. Bush signed into law the 21st Century Nanotechnology Research and Development. The legislation made nanotechnology research a national priority and created the National Technology Initiative (NNI). Today, the NNI is managed within a framework at the top of which the President's Cabinet-level National Science and Technology Council (NSTC) and its Committee on Technology. The Committee's Subcommittee on Nanoscale Science, Engineering, and Technology (NSET) is responsible for planning, budgets, implementation, and review of the NNI and it is comprised of representatives from 20 US departments and independent agencies and commissions

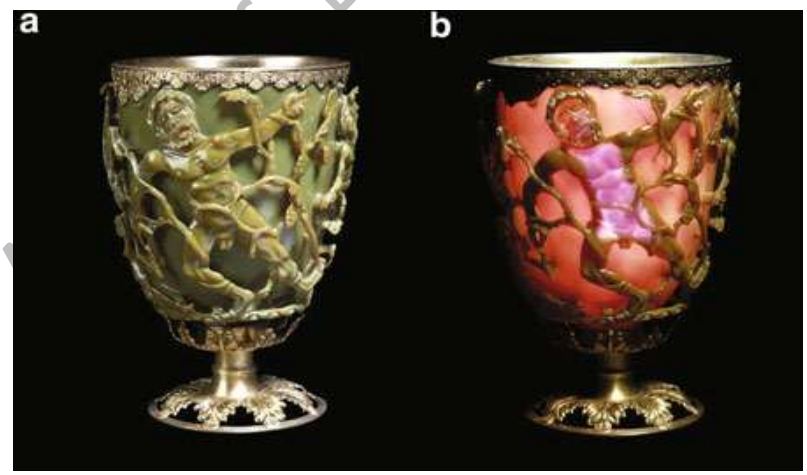

Figure 1.1: The Lycurgus cup in reflected (a) and transmitted (b) light.

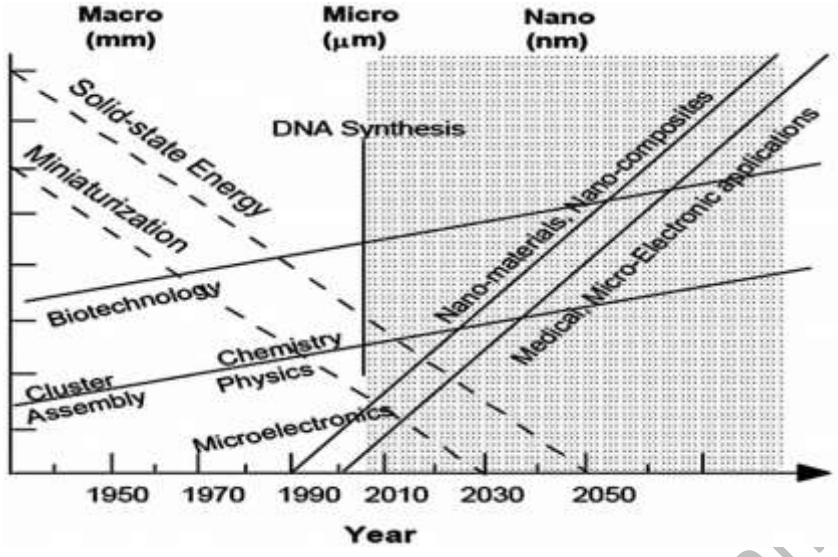

Figure 1.2: Evolution of science and technology and the future.

The use of nano-materials dates back at the fourth century AD when Romans were using nan-sized metals with Lycurgus cup that was fabricated from nano-particles (NPs) of gold and silver that were mixed in the glass. Lycurgus cup was fabricated from nano-particles (NPs) of gold and silver which mixed with glass material during the fabrication process Features Lycurgus cup is change its color with changing the incidence angle of light on the cup.

The idea of nanotechnology appeared for the first time by R. Feynman in the America-1959. Feynman described a process by which the ability to manipulate atoms and molecules maybe developed. The term of nanotechnology was originally defined by Norio in 1974 as follows: "Nano-technology mainly consists of the processing of separation and consolidation of materials by one atom or by one molecule."

The applications and uses of nano-materials, can be summarized as follows

i) **Medicine and Pharmacy**
ii) **Bio-sensor**
iii) **Electronics**
iv) **Engineering operations**
v) **Construction materials**
vi) **Food**
vii) **Energy**
viii) **Sunscreens and Cosmetics**
ix) **Paints**
x) **Displays**
xi) **Batteries**