



Fundamentals of nanotechnology

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Nanotechnology refers to the processing or production of submicron structures or bulk products built from components or materials of the size less than 100 nm. Nanotechnology includes investigation of physical phenomena at supra-atomic levels, creation of atomic clusters or compounds, generation of nanoparticles, deposition of nanothin films (nanocoatings, self-assembling monolayers, nanowires of thickness), spinning of nanofibers (carbon fibers, polymer fibers, nanotextiles, nanofabrics), and production of nanostructured materials (nanocomposites). There are two main approaches to the nanotechnology: the "top-down", which refers to physical or chemical machining of bulk materials down to nanometer scale by grinding, milling, etching, lithographing etc., and "bottom-up" which is a building of nanostructure from elementary components via molecule-by-molecule or grain-by-grain deposition, epitaxial growing, plating, intercalation, or implantation. The presentation will provide two main aspects of nanotechnology: research tools and manufacturing tools. Within the research tools, optical, atomic-force, ultrasound and electron microscopy as well as spectroscopy methods (Raman, Auger, energy dispersion, X-ray diffraction) will be discussed. The manufacturing tools will comprise subtractive processes: lithography (imprinting, photo, laser, X-ray, e-beam, ion-beam), etching (wet or plasma), and additive processes: physical vapour deposition, chemical vapour deposition, implantation, epitaxy, electroplating, electroprinting.