THE USE OF NANO MATERIALS IN THE DESIGN OF SPECIAL CLOTHING

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ABSTRACT

Nanomaterials are the most important part of nanotechnology. Materials whose unusual functional properties are determined ordered structure of their nanofragments ranging in size from 1 to 100 nm. The advent of nanoscience is impossible without understanding that the properties objects depend on its size and shape. This dependence has received the name of the size effect.

KEYWORDS: *Modernity, Structural Element, Dictionary Of Nanotechnology, Crystal Defects, Important Factor Acting In Nanomaterials.*

INTRODUCTION

The first to notice this dependence was Galileo Galilei in 1638, talking about the strength building beams and bones depending on their size. Modernity again made size effects topical due to the appearance of nanotechnology and nanoscience. In nano systems, starting from a certain moment, there appears size effect - dependence of the properties of nano systems on size nanoparticles.

Substances are classified as nanomaterials not only because they have a small characteristic size of the structural element, responsible for the manifestation of a particular property, but also because characteristics and this property depend on the size of the structural element. The manifestation of the size effect is a characteristic feature nanomaterial and is the subject of systematic research. Size dependence of the most significant for a given material properties allows you to answer such questions: does this material belong to the class of nanomaterials and at what sizes of structural elements the maximum gain in properties of nanomaterials is achieved.

Dictionary of Nanotechnology and related to nanotechnology terms defines the size effect (English effect of particle (grain) size) as “a complex of phenomena associated with a significant change in the physical chemical properties of a substance and arising due to: – direct reduction in particle size (grains, crystallites); – the contribution of interfaces to the properties of the system; – commensurability of particle size with physical parameters, having the dimension of length and defining the properties of the system - the size magnetic domains, electron mean free path, de Broglie wavelength, exciton size in semiconductors, etc. **[1]**

Size effects are observed when the size is reduced structural elements: particles, crystallites and grains below a certain threshold value. Such effects, called quantum mechanical, unusual for micro, macro and mega worlds, appear when the average the size of crystal grains does not exceed 100 nm, and most clearly appear at grain sizes less than 10nm. The first reason for the presence of size effects is a large proportion surface atom.

Unsaturation of atomic bonds near the surface. fraction of atoms, located in a thin near-surface layer of the order of 1 nm, grows with decrease in the particle size of the substance R, since the fraction of atoms S/V ~ R 2 /R3 ~ 1/R, where S is the particle surface, V is its volume. Lattice distortion near the surface. In addition, surface atoms have properties that differ from "bulk", because their connection with neighboring atoms is not the same as in the volume. Therefore, on the surface reconstruction atoms. The atoms are in a different order for example, crystal lattice distortion occurs near the surface, those. there is a different order of arrangement of atoms. **[2]**

Effective sink for crystal defects. atoms, caught on the edges of monoatomic terraces, ledges and depressions on them find themselves in special circumstances. The surface layer becomes new state of matter. The surface becomes a sink for most defects in the crystal structure, as a result of which it and "sucked out" from the volume to the surface and the object becomes more structurally perfect. Surface effects of mechanical properties. Wherein qualitatively change the transfer processes, which include the flow of electric current, thermal conductivity, plastic deformation etc. These changes occur due to the fact that effective mean free path of carriers in the volume of massive objects, where the particle size R >> Rf – effective length free path of carriers, weakly depends on the geometry of the object. Inside substances, scattering (or capture and death) of carriers occurs. AT Otherwise, when R < Rf, the situation is changing radically and all transfer characteristics vary greatly, starting to depend strongly on sample sizes. **[3]**

An important factor acting in nanomaterials is also tendency to the appearance of clusters (clusters of atoms, molecules). Relief migration of atoms (groups of atoms) along the surface and about the boundaries of the section, and also the presence of attractive forces between them, often lead to processes self-organization of island, columnar and other cluster structures. This effect is already used to create ordered nanostructures in optics and electronics.

The second reason for the specific properties of nanomaterials is an increase in the volume fraction of interfaces with a decrease in grain size, or crystallites in nanomaterials. It should be noted that the properties nanomaterials are defined not only dimension of the structural element, but also by the environment in which such an element is placed (structure boundaries, interfacial tension, etc.)

Mechanical properties. In the nanoworld is happening – increase in strength; – increase in hardness due to the absence of lingering defects in combined with high plasticity due to the developed netarticle of boundaries; – increase in yield strength; – decrease in the threshold of cold brittleness; - loss of plasticity. From mechanical properties: elasticity, plasticity, strength, fracture toughness depends on the need for high-strength structural materials and material consumption of products made from them. The strength of materials is determined by the chemical composition and the actual atomic structure (i.e., the presence of a certain crystalline lattice or its absence and the whole spectrum of its imperfections). High strength indicators can be achieved by two directly in opposite ways: – reducing the concentration of structural defects (in the limit approaching ideal single crystal state) – increasing it up to the creation of a finely dispersed nanocrystalline or amorphous about the state. Both ways are widely used in modern physical materials science and production. **[4]**

Magnetic properties. Nanomaterials are characterized by super magnetism, giant magnetoresistance, formation of magnetic fluids, pastes and polymers. Magnetic fluids are unique systems, combining the properties of a magnetic material and a liquid with the ability to control the magnetic field by rheological, thermophysical and optical characteristics.

The combination of these properties not found in known natural materials, discovered broad prospects for creation of technical devices with magnetic liquid as a articleing fluid. Magnetic fluids are colloidal dispersions (ferromagnets: magnetite, ferrites) with particle sizes from 5 nanometers up to 10 micrometers, stabilized in polar (water or alcohol) and non-polar (hydrocarbons and silicones) media using surfactants or polymers. They save stability for two to five years and have good fluidity in combined with magnetic properties. To obtain a magnetic fluid, it is necessary to solve several tasks: – it is necessary to obtain magnetic particles with a size of no more than 8 - 15 nm; – it is necessary to cover the particles of the dispersed phase with a layer of molecules stabilizer; – the stabilizer should not only prevent particles from sticking together, but also ensure the formation of a stable colloidal system of single-domain magnetic particles dispersed in the carrier liquid. **[5]**

Such a magnetic fluid can beget if, for example, mix castor oil with a well-ground ferromagnet (for example, iron hydroxide). Ferrofluids are colloidal solutions of a substance having the properties of more than one state of matter. In this case, two states are a solid metal and a liquid in which it contained. This ability to change state under the influence magnetic field allows the use of ferrofluids in as seals, lubricants, and can also open up other applications in future nanoelectromechanical systems. fluidity and magnetization. **[6]**

Magnetic fluids are unique in that that high fluidity is combined in them with high magnetization in tens of thousands of times greater than that of ordinary liquids. In spite of name, ferrofluids do not exhibit ferromagnetic properties, since they do not retain residual magnetization after the disappearance external magnetic field. actually ferromagnetic. liquids are paramagnetic and are often referred to as "super paramagnets" due to their high magnetic susceptibility. **[7]**

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