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Nanomaterials and its Various Applications in the Scientific World

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DESCRIPTION

Materials with grains smaller than billionths of a metre are referred to as nanomaterials, often known as nanocrystalline materials. They can be employed for both structural and non-structural applications and have qualities that are both appealing and practical. Nanomaterials can be utilized for a variety of purposes, some of which are listed below, because they have distinct, favorable physical, chemical, and mechanical properties. In the realm of microelectronics, the term "miniaturization" is used to describe the process of shrinking circuit elements including transistors, capacitors, and resistors. These parts are significantly smaller and run much faster in microprocessors, enabling substantially faster computations. However, a number of technical problems, including a lack of ultrafine precursors for these components, inadequate heat dissipation as a result of the greater speeds of the microprocessors, a slow mean time to failure, etc., limit these improvements.

Depleted Uranium (DU) projectiles (penetrators) have been used by the Department of Defense (DoD) in combat against enemy armored vehicles and hardened targets. Nanomaterials provide longer-lasting, more robust interconnections, nanocrystalline starting materials with better thermal conductivity, and ultra-high purity materials to manufacturers. The usage of DU is hazardous (carcinogenic), explosive, and lethal to employees because it still contains radioactive. However, two of the main justifications for its continued usage are the unique self-sharpening mechanism that DU penetrators possess upon impact with a target and the absence of a suitable non-explosive, non-toxic substitute for DU. These self-sharpening methods can be used with nanocrystalline tungsten heavy alloys because of their special deformation characteristics, such as grain-boundary sliding. As a result, research is being done on the potential use of nanocrystalline tungsten heavy alloys and composites as alternatives to DU penetrators. When nanocrystalline materials are created *via* the sol-gel process, the resulting structures are referred to as "aerogels" and have the appearance of foam. Despite being incredibly porous and light, these aerogels can support loads that are 100 times their weight. Continuous, three-dimensional networks of particles with trapped air between them make up aerogels. Because they are porous and contain air trapped in their interstices, aerogels are utilized as insulation in homes, offices, and other locations. As a result, cooling and heating costs are greatly reduced, energy is conserved, and environmental pollution is decreased. Furthermore, they are being employed as parts of "smart" windows, which illuminate when the sun is not shining and dim when it is.

Nanocrystalline materials have very wide grain boundaries that are proportionate to their grain size. They therefore play a significant role in their mechanical, chemical, and physical characteristics. Due to their enhanced chemical activity, nanomaterials can be utilized in power generating machinery and automobile catalytic converters as catalysts to react with noxious and poisonous gases like nitrogen oxide and carbon monoxide to prevent environmental pollution brought on by burning coal and gasoline. It is plainly obvious from the article's examples that a vast range of unique, brand-new, and current applications are possible for sol-gel-produced nanocrystalline materials. Furthermore, because of their improved formability and superior physical, chemical, and mechanical capabilities, nanomaterials perform better than their traditional equivalent materials in this category.

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CONFLICT OF INTEREST

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