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Innovative Composite Material with Pseudo-Porous Structure

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Abstract
This article will discuss a new generation of composite material, patented by scientist Nadezhda Iushkina and which is a new technology in many areas of application. The article will reveal the main characteristics of the material as well as ways of its use.

Key words: geology, technology, composition materials, innovation, scientists

Outstanding expert Nadezhda Iushkina, who is a talented inventor of a new innovative composite material, the base of which consists of artificial diamond microspheres, has created a fundamentally new type of composite with an internal structure that is pseudo-porous and extremely important for smart innovative technologies.

The new composite material, invented by Nadezhda Iushkina, is capable of rapidly absorbing and dissipating significant amounts of energy. The material is able to absorb and transmit significant amounts of energy over distances while maintaining maximum mechanical strength and reliability, preserving precise geometric shapes under the influence of high concentrations of temperatures, energy, and other harmful or extreme influences.

Formulation of the new composite material as a product:

- The composite material has a developed three-dimensional (volumetric) structure consisting of numerous identical multilevel spherical shells covering spherical cores; the cores with shells (capsules) are bonded together through a series of consecutive technological operations and have an equivalent contact structure shape for all capsules.
- The composite material has properties of super thermal conductivity and super electrical conductivity.

- The composite material has high mechanical strength, is not prone to internal mechanical and temperature stresses, and as a result of these phenomena - the occurrence of internal deformations.
- The composite material is capable of being subjected to high pressures and is capable, under the influence of these pressures, of at least some components entering a cold-flow regime, which allows calibrating the three-dimensional geometric shape of the structure and providing with a high degree of repeatability very precise geometric dimensions of the structure.
- The composite material, simultaneously serving as an electrical conductor and an efficient heat conductor, has a developed three-dimensional current-conducting structure, with uniformly distributed nodes (microspheres) in it, points of maximum thermal conductivity, which are not electrical conductors. The material has the appearance of a three-dimensional lattice in the nodes of which diamond spheres are located, which are the best-known heat conductors, separated in the three-dimensional space of the structure by copper shells, which are excellent conductors and heat conductors.

Thus, for electrical current (most crucially for pulse mode current), the composite structure acts as a sort of pseudo-spongy or pseudo-porous volume because throughout the specified volume of the current-conducting material, dielectric spherical spaces are uniformly distributed, comparable in size to the dimensions of the current-conducting space.

This fact contributes to the rapid and uniform dissipation of current on one hand, and rapid, efficient, and uniform heat dissipation on the other hand, due to phenomena occurring within the same volume of the material.

As materials for the shells of diamond spheres, the most ductile known materials are provided, for example - copper or silver, which possess the maximum known electrical conductivity; under the influence of high pressure in a confined volume, these metals can be brought into a cold-flow state. Assuming the application of high pressure in a three-dimensional confined volume, the character and form of interaction between capsules in the structure are modified, allowing the formation of products in the required technical condition, which is impossible to achieve using conventional technologies.

The new material can acquire its unusual properties due to corresponding technological methods, which, due to their originality, become the basis for an original complex technological process, an object of integrative basic invention, and a series of applicative inventions aimed at the development and improvement of the properties of the specified composite materials and their derivatives.

Options for defining the production technology of the new composite material, as outlined by Nadezhda Iushkina in her original developments:

- Method of manufacturing pseudo-porous composite material, representing a multitude of nano-capsules bonded together into a three-dimensional structure, subjected at the final stage of production to volumetric plastic calibrating deformation in a cold-flow regime for the material of the ductile shells of nano-capsules.
- Technologies for producing diamond nano-powder and subsequent coating with copper or other ductile metals, a technique relatively known in terms of technology principles, but requiring relative modification in subsequent stages of the project.

The proposed composite material, after completion of all operations for its production, acquires the appearance of a finished geometric structure, for example, a prism, which should be considered as a current-conducting object, within which dielectric spheres made of synthetic diamonds are uniformly distributed.

The cross-section of such a conductor is sufficiently large, and thanks to the developed volumetric structure, such a conductor has low electrical resistance. Since there are inclusions of diamond grains (spheres) within the volume of the current-conducting structure, which are not conductors of electricity, the current bypasses these zones in the body of the structure and only passes through the current-conducting volume.

This scheme of current dissipation or distribution across a relatively large cross-section allows for a sharp reduction in losses and accelerates the passage of current. In the case where there is a need to dissipate heat, the pseudo-porous structure represents nodes of a specific lattice in the

nodes of which diamond spheres are located, the thermal resistance of which is several times lower than that of the overall structure, therefore heat is directed to the nodes of the lattice, ensuring very rapid and intensive heat dissipation from the source of its generation.

Thus, in both cases, a phenomenon of spotted three-dimensional distribution of zones with different specific thermal conductivity and electrical conductivity coefficients is created. Additionally, the sizes of the capsules on a nanometer scale and the finishing plastic deformation in a cold-flow regime allow for significant reduction of gaps between capsules, enhancing the efficiency of heat extraction and dissipation of current pulses.

The calculated and expected effect of heat dissipation exceeds the best indicators in existing technical solutions by 4-5 times.

The objective set in the mentioned invention is determined by the properties of the invented material and enables achieving an increase in the power of electronic devices when applying it, with the intention of using the proposed materials while reducing their dimensions. Additionally, it aims to enhance the reliability level of devices and prolong the lifespan of electronic devices.

Thus, Nadezhda Iushkina has made a significant contribution to the development of future technologies, and her developments will be utilized in cutting-edge projects, substantially altering many industries.