TO STUDY THE DISTRIBUTION OF THE DENSITY OF THE RADIANT ENERGY FLUX IN THE FOCAL PLANE OF THE PARABOLOID OF CYLINDRICAL CONCENTRATORS

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Abstract: This article distribution of the radiant energy density in the focal plane of concentrating mirrors obeys the law of the normal distribution of probability theory (Gauss distribution), in which small inaccuracies in the shape of the reflector are considered random. In modern materials science and technology of composite materials for functional coatings, nanodisperse fillers and modifiers obtained from various semi-finished products, including natural ones, play a special role

Key words: concentrating, reflector, Gauss distribution, composite materials, nanodisperse fillers, modifiers, component, particles, nanocomposites, nanostructures, nanomaterial, synthesis, condensation, thermolysis, dehydroxylation.

Numerous authors, for example, [1, 3, 4, 5] it is logically assumed that the distribution of the radiant energy density in the focal plane of concentrating mirrors obeys the law of the normal distribution of probability theory (Gauss distribution), in which small inaccuracies in the shape of the reflector are considered random.

In modern materials science and technology of composite materials for functional coatings, nanodisperse fillers and modifiers obtained from various semi-finished products, including natural ones, play a special role. The comparative availability of mineral raw materials, which are often technological waste from the production of construction products, metal structures, mineral fertilizers, etc., along with the effective modifying effect of highly dispersed rock particles, determine its expanded use in practical materials science.

Low-dimensional particles of a certain composition, structure, shape and activity are the most important component of functional materials on polymer, metal, ceramic and other matrices that determine the mechanisms for implementing the specified parameters of service characteristics. Low-dimensional particles are of interest not only as objects of multiphase multicomponent systems, the creation and application of which is carried out within the framework of special areas of hi-tech technologies and materials science (nanomaterials and nanotechnology), but also as independent objects, the parameters of the characteristics of which differ significantly from the tabulated data of bulk particles.

In the analysis of very numerous studies devoted to various aspects of the technology of obtaining low-dimensional particles [5, 6, 7, 8], It is necessary to emphasize two characteristic aspects:

-firstly, the range of nanoparticle production technologies is rapidly expanding due to the development of hi-tech hardware design - technologies based on the use of both traditional methods of nanoparticle synthesis (dispersion, thermolysis of precursors, chemical and electrochemical deposition, etc.) and high-energy flows (laser, electronic, ionizing, thermal, etc.);

Secondly, the nomenclature of low-dimensional particles of interest for materials science and technology of functional materials is expanding due to the intensive development of instrumental methods of visualization and investigation of objects with sizes less than 100 nm (scanning electron, tunneling, atomic force microscopy, X-ray diffraction analysis, etc.).

These aspects of nanomaterial science and nanotechnology necessitate a systematic analysis of the methodological principles underlying modern nanomaterial science in order to identify the most promising directions for the development of technology for obtaining low-dimensional particles of various composition, structure and modifying action.

In this section, an attempt is made to classify various methods for obtaining nanoparticles based on various methodological principles, followed by an analysis of the features of their shape (habitus), charge state and activity in the processes of interaction with matrices differing in nature, composition and structure.

The analysis of well-known literature sources devoted to the methods of obtaining nanoparticles [49, 50, 54] revealed the basic principles underlying the technologies and determining the mechanisms of formation of material objects with dimensions up to 100 nm in at least one direction:

-dispersion of condensed semi-finished products, including mineral;

-condensation of atomic and molecular ingredients on active centers in various media and systems (single-phase and heterophase);

-synthesis from components in atomic, molecular and condensed (phase) states in various media carriers.

Systematization of the most common approaches to the production of nanoparticles used in modern functional materials science, using the proposed principles, allowed us to identify promising technologies that ensure the production of nanoproducts with specified parameters of service characteristics.

The use of thermal effects on the semi-finished product allows not only to obtain nanoparticles due to the destruction (thermolysis) of the precursor, but also as a result of secondary thermochemical processes, for example, dehydration, dehydroxylation, etc.

Such technologies are intensively used in the production of nanoparticles based on metals, oxides, silicates, graphite and other compounds with a layered structure of the crystal lattice [54].

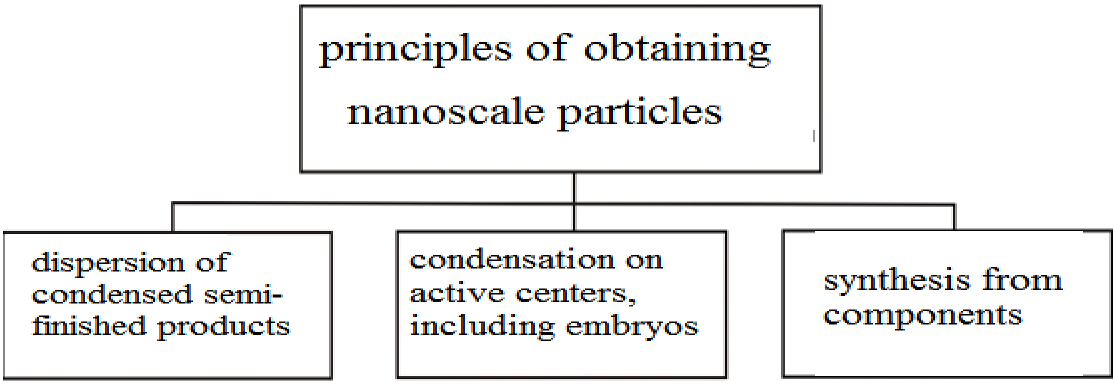


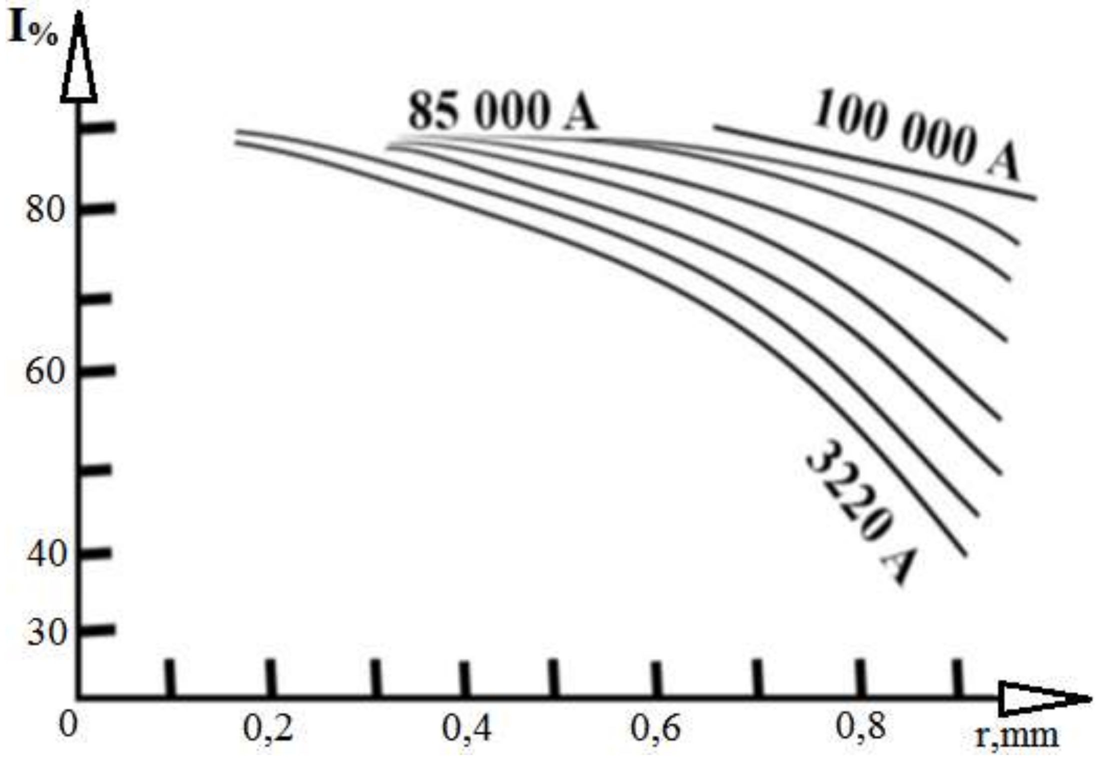
Figure 1. Principles of obtaining nanoscale modifiers of polymer matrices.

Under the action of concentrated energy flows on the semi-finished product (laser, ionizing, thermal), the dispersion of surface layers is ensured by the mechanism of destruction of thermodynamically nonequilibrium areas with defects of various sizes, origin and mechanism of formation.

For example, under the concentrated action of laser beams or streams of charged particles, infrared radiation on a polymer semi-finished product, the destruction of pass-through macromolecules in the amorphous phase, localized impurities, low-molecular and oligomeric fractions, imperfect (defective) supramolecular formations and other unstable structures occurs, which causes the formation of low-dimensional particles capable of repolymerization, monolithization and condensation on solid substrates. This technology has a variety of applications – from the formation of functional coatings (applying, decorative, hydrophobic, tribotechnical, insulating) on the surfaces of parts of tribosystems, power equipment, protective structures, semi-finished composite materials in the form of fibers, fabrics, products, etc. to the production of nanodispersed particles used as components of structural, tribotechnical materials, lubricants, paints, lubricants, cooling and technological media [6, 8].

It is known that the intensity (brightness) of energy emission by the solar disk decreases from the center to the edges. The change in intensity also depends on the wavelength and, as shown in Figure 2, it is the greater the shorter the wavelength. The attenuation is caused by absorption in the solar atmosphere. Selectivity is explained by the dependence of absorption on wavelength [2].

Figure 2. Intensity (brightness) of radiation along the radius of the solar disk for different wavelengths.



When reflecting the sun's rays with a correct parabolic concentrator, the distribution of energy on the image area, i.e. in the focal plane, should be identical with its distribution across the solar disk.

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Due to inaccuracies in the manufacture of the concentrator, installation, tracking and a number of other factors, the beam of sunlight after reflection falls on the focal plane significantly scattered, distorted and attenuated.

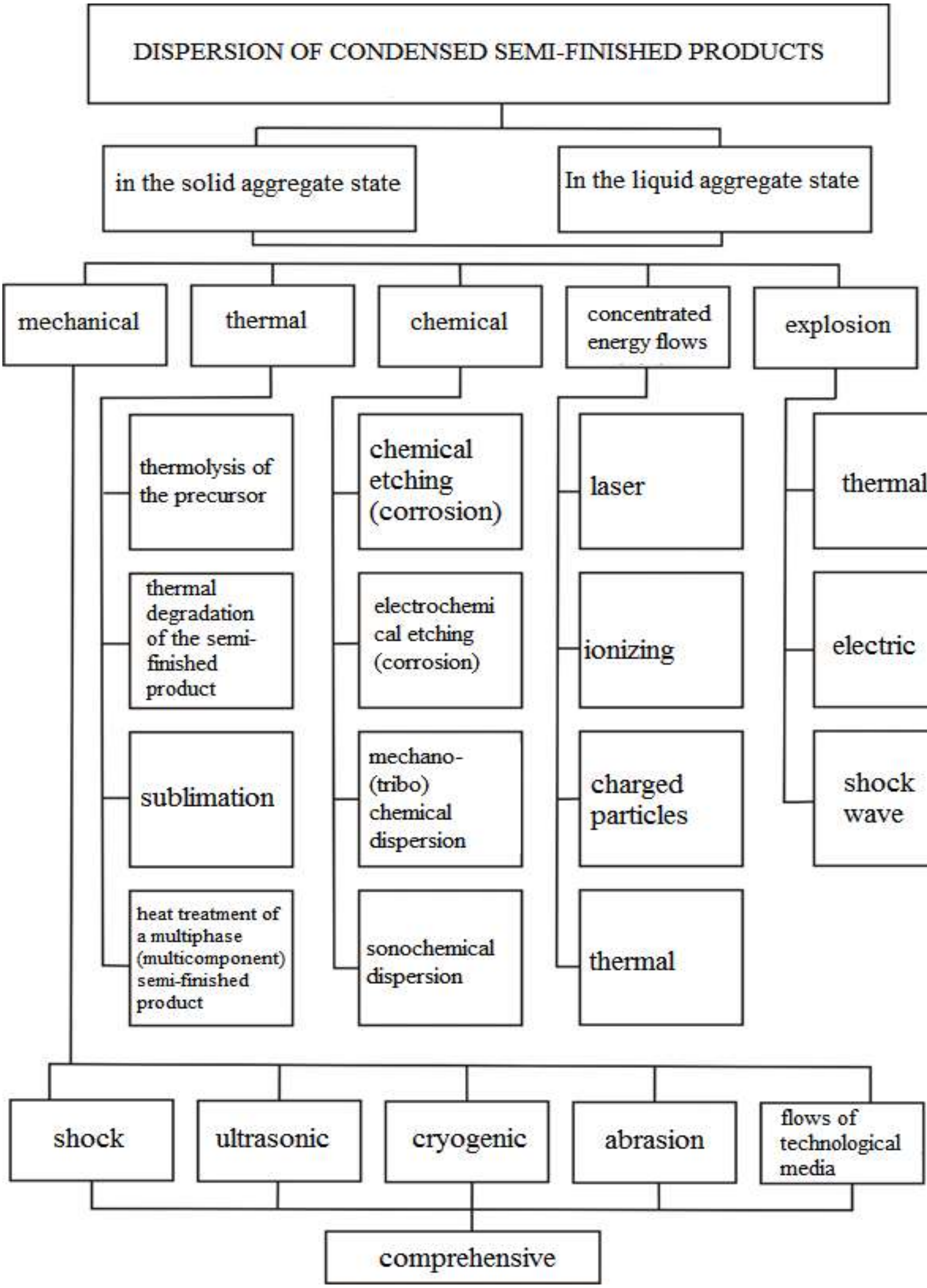

Figure 3. Methods for obtaining nanoscale particles by dispersing condensed semi-finished products.

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