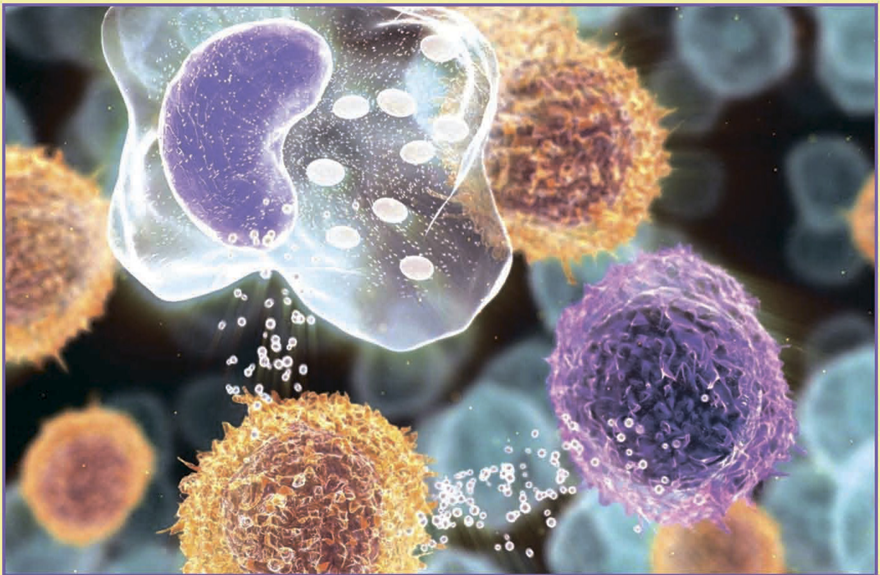
Nano- and microheterogeneous systems in construction

Study Guide



Arkhangelsk 2018

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Ministry of Science and Higher Education of the Russian Federation
Northern (Arctic) Federal University named after M.V. Lomonosov

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A.M. Ayzenshtadt
Nano- and microheterogeneous systems in construction: Study Guide

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Questions of the terminology of nano- and microheterogeneous systems, the main methods of their production and classification are considered. A characteristic of the important properties of these systems associated with surface phenomena at the interface is given. The classical and developed original methods of performing laboratory works with the use of modern unique equipment are presented.

This tutorial is intended for the training of students at the student’s program 08.04.01 "Construction", and can be recommended for students, masters and postgraduates involved in the study of properties different dispersed systems.

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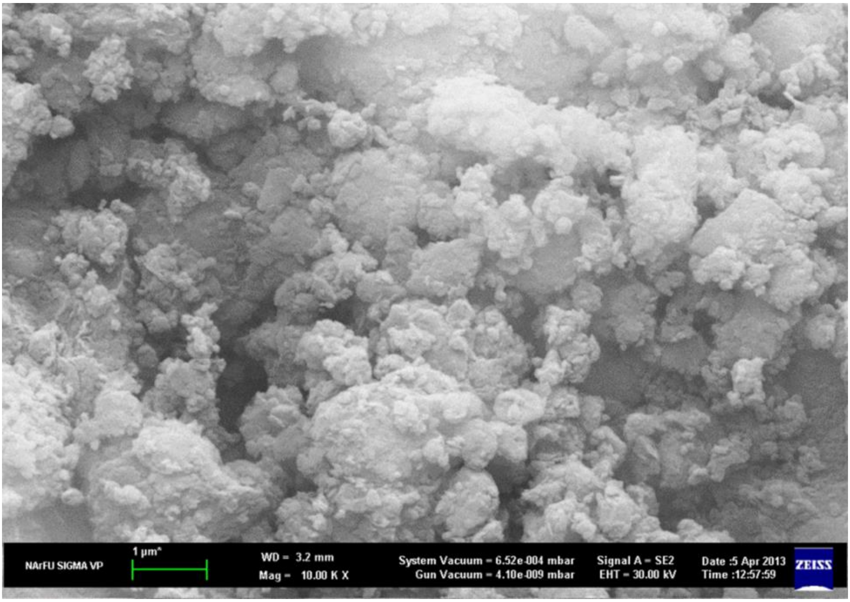
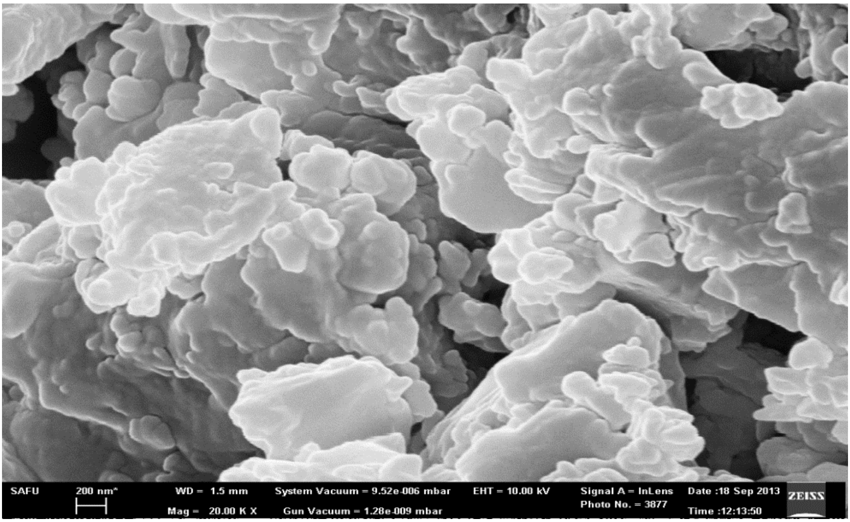
Introduction

The field of application of nano- and microheterogeneous systems in the construction industry is enormous – these are technologies for obtaining a variety of disperse products (powders, pastes, emulsions, suspensions, etc.), including composite (concrete, reinforced concrete, paving tiles, etc.) and nanocomposite (astringent, heat-insulating) of building materials, silicates (especially ceramics and glass), dispersed porous structures (styrofoam, primers) of plastics, glues, varnish-and-paint materials, etc. Since the particles of the dispersed phase and the surrounding dispersion medium in these systems have a very large phase interface (particle size of the dispersed phase is from fractions of microns to tens of nanometers (next nm)), with increasing dispersity, surface phenomena have a determining effect on the properties of disperse systems. Along with this, many physical properties (color, melting point, electrical conductivity, density), which for large volumetric bodies do not depend on the size, they acquire this dependence, when the particle size decreases below a certain border, which is usually 100 nm. On this basis, authors of educational-methodical tutorial found it possible to do a conditional dimensional border and in the representation of material, divided into two parts: the first section is devoted to methods of obtaining and determining the characteristics of nanodispersed systems (particle size of 10 to 100 nm), the second is related to studies of the properties of microdispersed materials characterized by larger particles of the dispersed phase.

The study guide includes the main theoretical material, presented in a concise form, reflecting possible ways of classifying and the properties of systems. In addition, the methodical sections of the guide describe how classical techniques perform a variety of experiments, and the original laboratory work carried out using the most modern



Picture 6. Mechanoactivated surface modifier (magnification 10000 times)



Picture 7. Surface modifier layer on autoclaved modified wood sample (magnification 20000 times)

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