Level: PhD

Course title: Advanced course of disordered systems

Status: elective

ECTS: 15

Requirements:

Learning objectives

Mastering the knowledge of modern scientific achievements related to the materials with non-crystalline structure as functional components of the classic and new technologies. Acquiring the practical skills required for solving specific problems, and the ability to connect knowledge from different fields of materials science in the application of information technology.

Learning outcomes

After completing and mastering the course, students acquire the knowledge, skills and competences in the field of non-crystalline materials to solve practical and theoretical problems, ability of scientifically based understanding of physical processes and interpretation of physical phenomena in the field of disordered and partly ordered materials, ability to realize certain technical solutions, and ability to communicate on a professional level in presenting the scientific research results.

Syllabus

Theoretical instruction

Technological aspects of structuring polyphase - multicomponent materials. Influence of structure on the properties of non-crystalline materials. Partially ordered systems. Thermotropic and lyotropic liquid crystals. Methods of analysis the synthesis kinetics and networking of macromolecules in polymer materials. Modern methods of obtaining macromolecules. Fullerenes, nanotubes, nanowires and other 1D- nanostructures, synthesis, characterization and application of these materials. Obtaining of glasses. Phases in the process of glass-ceramics obtaining. Obtaining of amorphous metals. Obtaining of amorphous thin and thick films. Phase transformations in liquids and glasses. Electronic states in glasses. Temperature dependence of density of electronic states. Photo-structural transformations and effects on the structural glass network. Optoelectric properties and application of amorphous semiconductors. Optical memories.

Defects in condensed systems: glasses, crystals, quasicrystals, liquid crystals, magnetic materials and superfluid liquids. Structural defects and plasticity of metallic glasses. Grain boundaries and transformation of metals to amorphous state. Topology of defects in condensed systems: topology of singular defects, nontrivial topological excitations: defects, solitons, textures, ensembles of topological defects. Defects and structure of quasicrystals: dual and projection methods for description and construction of quasicrystal lattice, deformation of quasicrystal lattice, topology of defects in quasicrystal lattice.

Practical instruction

Application of the selected methods for characterization of spectroscopic properties of materials. Preparing and public presenting of seminars that accompany and supplement the course content.

Weekly teaching load				Other:
Lectures: 6	Exercises:	Other forms of teaching:	Student research: 4	
