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BSUIR Professor Publishes an Article in a Major International Scientific Journal

We congratulate Professor, Doctor in Physical and Mathematical Sciences Sergei Prischepa with publishing an article in the high-ranking British journal "Journal of Physics: Condensed Matter".

Article topic: "Phonon Softening in Nanostructured Phonon–Mediated Superconductors (review)".

This is a thematical review of different aspects of changes of phonon spectrum in nanostructured phonon-mediated superconductors, as well as a short review of world science latest achievements, trends, and perspectives for the development of this field of science.

Abstract to the article is presented below. You can read the full version of the text by subscribing to the journal via: <https://iopscience.iop.org/>.

IOP Publishing

Journal of Physics: Condensed Matter

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Topical Review

Phonon softening in nanostructured phonon–mediated superconductors (review)

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Abstract

Various aspects of phonon spectrum changes in nanostructured phonon-mediated superconductors are considered. It is shown how, with the development of experimental techniques and, accordingly, obtaining new results, the understanding of the influence of the surface and nanoscale on the magnitude of the electron–phonon interaction and the critical temperature T_c changed and deepened. The review is organized as follows. After the *Introduction*, in the *second* part we give the quick theoretical background for the description of superconductivity within the framework of various formalisms. In the *third* part we describe the properties of nanostructured (granular) thin films paying attention to the impact of grain sizes and methods of deposition on the T_c value. The role of material parameters is underlined and different aspects of the behavior of granular thin films are discussed. In the *fourth* section the impact of external sources of modification of the phonon spectra like noble gases and organic molecules are considered. Problems and progress in this area are discussed. The *fifth* part is dedicated to the phonon modification and related quantum size effects in nanostructured superconductors. In the *sixth* part we review the results of direct evidence of phonon softening in nanostructured superconductors and in the *seventh* section we discuss a possible alternative description of the superconducting properties of nanostructured superconductors related to the concept of metamaterials. In the *eighth* and *ninth* parts we review the impact of substrates with lattice mismatched parameters and graphene sheets, respectively, on the modification of the phonon spectrum and enhancement of superconductivity in various superconducting thin films. Finally, in the last *tenth* section we consider the nonequilibrium superconductivity driven by femtosecond pulses of light, which leads to generation of coherent phonons and to a significant increase in the critical temperature in a number of superconducting materials.

Keywords: superconductivity, nanostructure materials, Eliashberg function, phonons, electron–phonon interaction

(Some figures may appear in colour only in the online journal)

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“Journal of Physics: Condensed Matter” covers the whole field of physics of condensed matter, including soft matter, biophysics, and physics of chemical processes. The articles may indicate experimental, theoretical, and imitational research.

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Sergei Prischepa is the professor of the department of Information Protection, head researcher of the R&D laboratory “Materials and Components of Electronics and Superconducting Equipment”. He is an active participant of republican and international conferences. In the last 5 years the professor published 99 printed editions. H-index (Scopus) – 18, citation index – 1084.

Recently, Doctor Prischepa participated in the cycle of open lectures by BSUIR. The topic of the open lecture was "Physical Properties of Superconducting Spintronics". More at the web-site.

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