

Review

of the member of the dissertation council for the dissertation of *Balanov Mikhail Ivanovich* on the topic: « STRUCTURAL, ELECTRONIC AND OPTICAL PROPERTIES OF HYBRID COMPOUNDS BASED ON LEAD HALIDES AND A HOMOLOGOUS SERIES OF DIAMINES OF THE FORM $[H_3N-(CH_2)_n-NH_3]PbX_4$ ($n=4-8$, $X=Cl, Br, I$) », submitted for the degree of *candidate* of Physical and Mathematical Sciences (*candidate* of sciences in physical and mathematical sciences) in scientific speciality 1.3.8. Condensed Matter Physics

This dissertation aims to establish the influence of the straight-chain saturated alkanediamine cations ($n=4-8$) and the type of halide anions (Cl^- , Br^- , I^-) on the structural, electronic and optical properties of organic-inorganic hybrid perovskites. A number of perovskite samples, up to 15, are investigated in the dissertation, and modern experimental techniques and methods are involved in the investigation. The dissertation consists of an introduction, 3 chapters, a conclusion, acknowledgements and a reference, including 10 tables and 78 figures.

In the first chapter, a literature review is conducted on halide perovskite materials, covering inorganic perovskites, organic-inorganic hybrid perovskites, and low-dimensional hybrid perovskites based on diamine cations. On the basis of literature review, the significance and novelty of this dissertation is figured out.

In the second chapter, the optimized synthesis procedures of the 15 types of hybrid perovskites are described in detail. Methods for measurements as well as numerical calculations and computer modeling are introduced.

In the third chapter, the structural, electronic, optical properties as well as phase change behavior of the 15 low-dimensional hybrid perovskites are investigated, and the parity effect of the carbon skeleton of saturated alkanediamine cations is manifested. Among of them, 5 types of hybrid perovskites are investigated for the first time, the parity effect of the carbon skeleton of diamine cations on the structural, electronic and optical properties of hybrid perovskites are investigated for the first time and its dependence on halide anions are discussed. The low-temperature luminescent properties and the phase change behavior of the low-dimensional hybrid perovskites are investigated systematically.

Overall, the dissertation presents a solid and comprehensive research on low-dimensional hybrid perovskites materials. The results of the presented dissertation research are given in 3 publications in peer-reviewed journals, including two first-authored publications. The main conclusion of the dissertation will inspire the research on hybrid halide perovskites and will be an important reference to researchers working on the relative research area.

Considering the above, I believe that

Balanov Mikhail Ivanovich's dissertation on the topic: « STRUCTURAL, ELECTRONIC AND OPTICAL PROPERTIES OF HYBRID COMPOUNDS BASED ON LEAD HALIDES AND A HOMOLOGOUS SERIES OF DIAMINES OF THE FORM $[H_3N-(CH_2)_n-NH_3]PbX_4$ ($n=4-8$, $X=Cl, Br, I$) » meets the requirements of speciality 1.3.8. Condensed Matter Physics;

The dissertation is

A scientific qualification work that resolves a scientific problem important for the development of the relevant field of science *or* provides new science-based technical, technological or other solutions and developments vital for the national development.

No violations of paragraphs 9 and 11 of the Order No.11181/1 as of November 19, 2021 "On the Procedure for Awarding Academic Degrees at St. Petersburg State University" have been detected.

The dissertation meets the criteria of dissertations for the academic degree of candidate of sciences, established by the specified Order. The dissertation is recommended for the defense at St. Petersburg State University.

Member of the dissertation council



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Dec. 2nd, 2024

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