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Report

on the thesis presented by Anton Maevskiy, entitled “PHOTOSTIMULATED PROCESSES IN METAL–ORGANIC FRAMEWORK MOF-76 BASED ON RARE EARTH METALS” for degree of a Candidate of Sciences in 1.3.8. Condensed Matter Physics – The Saint-Petersburg State University.

Metal-organic frameworks (MOF's) based on rare earth metals are good systems for both fundamental and applied studies due to their highly tailored structure as well as tunable photoluminescence. While extensive research has been conducted on the system, the effect of photostimulation on the optical properties of rare earth MOF's is still less investigated. In the thesis reviewed, the author presents a comprehensive research on the effect of ultraviolet irradiation on the spectral absorption and photoluminescent properties of multi-rare earth MOFs with the highly stable MOF-76 structure. It is shown that the photostimulation does affect the optical properties of MOF-76 based on europium and yttrium, but in different way dependent on the spectral ranges of photostimulation and the type and concentration of rare earth elements. The mechanism of photochemical and photophysical processes in the process of photostimulation is proposed. The possibility of obtaining white phosphors based on the photostimulation approach is demonstrated. Therefore, the research presented in the thesis has both theoretical and practical significance for the subject of study.

In the first chapter the thesis begins by offering a comprehensive literature review on the general background of MOF's including the history, concept, structure and synthesis, on the photophysics of rare earth ions, and on the possible photoluminescence applications of rare earth MOF's. The representative works on rare earth MOF's was reviewed in this chapter.

In the second chapter the thesis introduces the reproducible method for the synthesis of single- and bimetallic MOF's with different contents of yttrium and europium. The obtained samples were carefully characterized, and the spectral ranges of photostimulation were chosen.

In the third to fourth chapters, the thesis reports the effect of photostimulation on the optical properties of MOF-76 containing yttrium, europium and the both with different europium contents. Spectral ranges of 260- 360 nm and over 360 nm showed different effect on the spectral absorption and photoluminescent properties of the MOF's. The effect of the ratio of europium to yttrium on the changes in the photoluminescent of the samples upon photostimulation in different spectral ranges was revealed. The mechanism of photochemical and photophysical processes occurring in the europium/ yttrium-based MOF-76 structure was proposed.

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In the fifth chapter, the thesis presents a new photostimulation approach to tuning the color of the glow of rare earth MOFs. It shows that UV-stimulation significantly change the color of the luminescence of the samples and the color change depends on the time of UV irradiation. By rational selection of rare earth components, it is very possible to create a MOF's material with the ability to tune the luminescence color by external photostimulation, including for obtaining white glow.

Overall, the thesis presents a comprehensive and insightful research on the effect of photostimulation on the optical properties of rare earth MOF's and proposes a new photostimulation approach for tuning the glow color of the MOF's. The results of the research have resulted in 2 patents, and been published in 1 peer-reviewed scientific paper and presented as 10 conferences reports. The main conclusion of the thesis will undoubtedly inspire the research on the photofunctional MOF's and help the development of MOF's-based luminescence applications.

The only shortage I can see is the thesis contains several mistakes in typewriting. However, these mistakes do not spoil the positive impression made by the research. I can fairly conclude that the thesis entitled "PHOTOSTIMULATED PROCESSES IN METAL-ORGANIC FRAMEWORK MOF-76 BASED ON RARE EARTH METALS", by Anton Maevskiy, deserves to be awarded the degree of Candidate of Physical and Mathematical Sciences.

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