THE 67TH INTERNATIONAL

OPEN READINGS

CONFERENCE FOR STUDENTS OF PHYSICS AND NATURAL SCIENCES

BOOK OF ABSTRACTS | 2024

Vilnius University

VILNIUS UNIVERSITY PRESS

Editors:

Martynas Keršys
Rimantas Naina
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Cover and Interior Design:

Goda Grybauskaitė

Vilnius University Press
9 Saulėtekio Av., III Building, LT-10222 Vilnius
info@leidykla.vu.lt, www.leidykla.vu.lt/en/
www.knygynas.vu.lt, www.journals.vu.lt

Bibliographic information is available
on the Lithuanian Integral Library Information System (LIBIS) portal www.ibiblioteka.lt
ISBN 978-609-07-1051-7 (PDF)

ACHIEVING LONG-LASTING ROOM TEMPERATURE PHOSPHORESCENCE IN PHENOTHIAZINE CRYSTALS

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Room temperature phosphorescence (RTP) has a great potential to be used for various applications in sensing, data encryption, anti-counterfeiting, bioimaging and microcrack detection owing to their unique photophysical properties [1]. Typically, RTP emission is achieved in inorganic material-based systems, including rare earth metals, which are associated with high processing costs, poor biocompatibility, etc. Recently, the focus has shifted to organic RTP systems due to their tunability of emission wavelength, low cost and ease of processing.

For practical applications, RTPs must be efficient and have a long phosphorescence lifetime, which is in principle a challenging task, since promoting intersystem crossing for high-yield triplet generation usually accelerates their lifetime [2, 3]. It is therefore necessary to understand the mechanisms that determine long and efficient RTP and to identify the limiting factors of the processes involved in RTP, so that new RTP systems with improved RTP properties can be achieved.

In this work, new phenothiazine 5,5-dioxide RTP emitters have been synthesized and their RTP properties have been studied. All three phenothiazine 5,5-dioxide based compounds adopted crystal structure which ensured rigid environment for reduced non-radiative triplet deactivation allowing to achieve RTP in the green spectral region with phosphorescence lifetime up to 0.85 s. In addition, it has been shown that rigid crystal structure hampered permeability of atmospheric oxygen therefore retained triplet lifetime even working under ambient conditions.

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