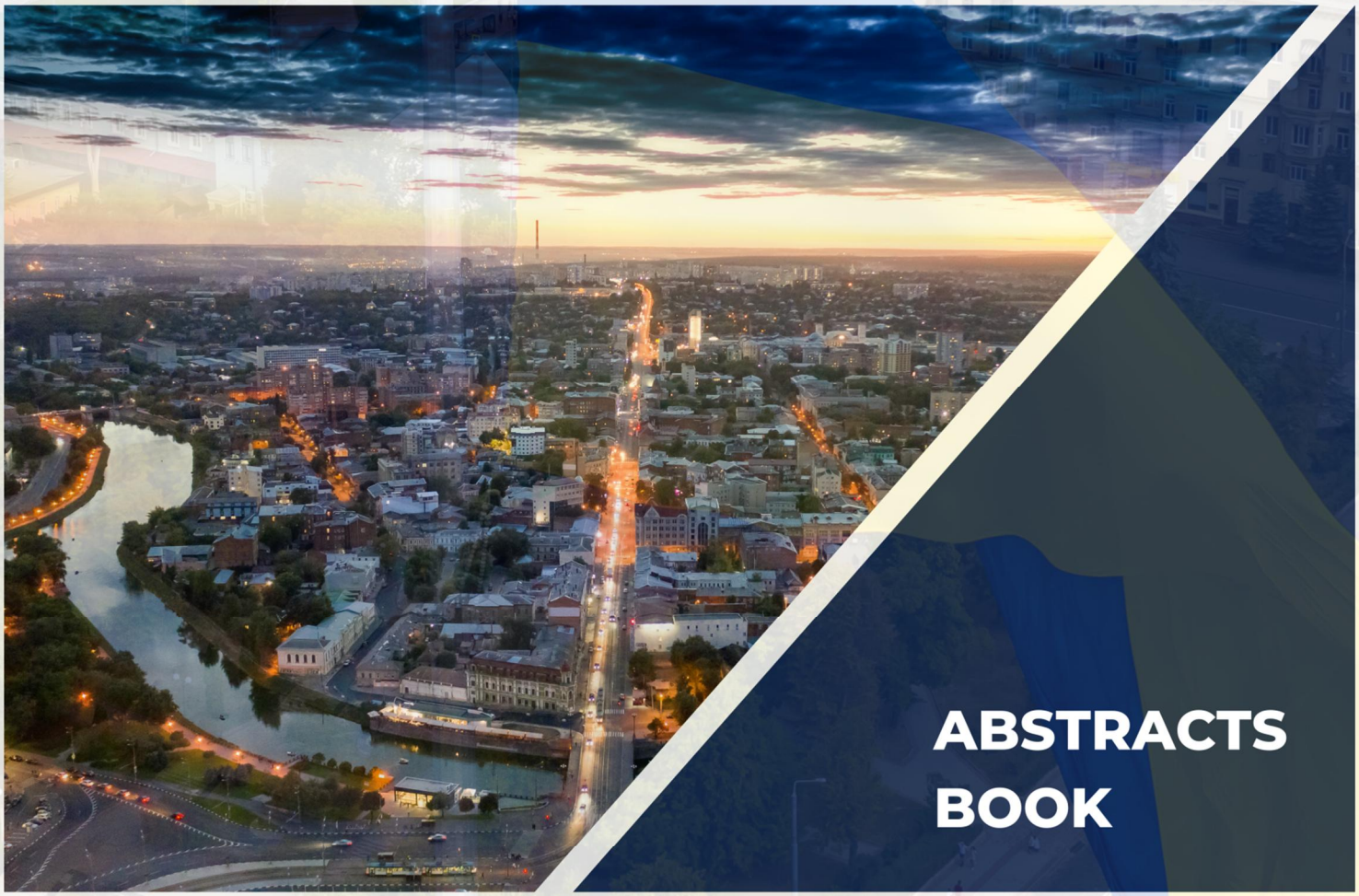
IV International Conference

CONDENSED MATTER & LOW TEMPERATURE PHYSICS 2024

3rd — 7th June 2024 | Online



ABSTRACTS BOOK

B. Verkin Institute for Low Temperature Physics and Engineering of NAS of Ukraine

IV International Conference
“CONDENSED MATTER & LOW-TEMPERATURE PHYSICS”

June 3 – 7, 2024

Conference Program

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Book of Abstracts

Kharkiv 2024

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Reversible luminescent hydrogen peroxide sensors based on CeO_{2-x} and $CeO_{2-x}:Eu^{3+}$ nanocrystals

P. Maksimchuk[1], Ye. Neuhodov[1], K. Hubenko[1], A. Onishchenko[2], S. Yefimova[1], V. Seminko[1]

[1] Institute for Scintillation Materials NAS of Ukraine, 60 Nauky Ave., Kharkiv, 61072, Ukraine
[2] Kharkiv National University of Radio Electronics, 14 Nauky Ave., Kharkiv, 61166, Ukraine
e-mail: pavel.maksimchuk@gmail.com

Hydrogen peroxide (HP) is a widespread industrial chemical widely used for bleaching, cleaning, and disinfection. HP also plays an indispensable role in living organisms being a ubiquitous cell signaling molecule [1] and a substrate or byproduct of a number of enzymes (including catalase, superoxide dismutase, and a number of oxidases and peroxidases) [2]. So, HP sensing is required for reliable quantification of HP content in these systems.

HP sensors based on luminescent inorganic nanoparticles can be considered as a perspective alternative to traditional dye- and enzyme-based sensors which usually are unstable and non-reversible. Undoped (CeO_{2-x}) and Eu^{3+}-doped ($CeO_{2-x}:Eu^{3+}$) colloidal ceria nanoparticles provide HP detection by reversible quenching of Eu^{3+} (590 nm) and Ce^{3+} (430 nm) luminescence bands [3]. The dynamics of Eu^{3+} and Ce^{3+} luminescence quenching and recovery during HP-nanoceria interaction provides an insight into the microscopic mechanisms of HP sensing by CeO_{2-x} and $CeO_{2-x}:Eu^{3+}$ nanoparticles.

Both CeO_{2-x} and $CeO_{2-x}:Eu^{3+}$ luminescent sensors are reversible and their recovery rates can be sufficiently increased by temperature and continuous UV irradiation. At the same time, Eu^{3+} ions deteriorate the catalase-mimetic activity of CeO_{2-x} NPs and worsen their antioxidant properties that should be keep in mind while using these sensors in biological media.

[1] D. R. Gough, T. G. Cotter, Hydrogen peroxide: a Jekyll and Hyde signalling molecule. Cell Death Dis. 2011, 2(10), e213-e213.
[2] 2.Copeland, R. A. Enzymes: a practical introduction to structure, mechanism, and data analysis. John Wiley & Sons: 2000.
[3] V. Seminko, P. Maksimchuk, V. Klochkov, Ye. Neuhodov, L. Demchenko, S. Yefimova. Reversible CeO_{2-x} and $CeO_{2-x}:Eu^{3+}$ Luminescent Hydrogen Peroxide Sensors with Recovery Rates Controlled by Temperature and UV Irradiation, The Journal of Physical Chemistry C, 2023, 127 (22), 10662-10669.