International Conference on Functional Nanomaterials and Nanodevices

27-30 August 2023 | Warsaw, Poland

ABSTRACT BOOKLET

Sponsorship for "Best Poster Awards"

Ossila enabling materials science

electronics an Open Access Journal by MDPI

energies an Open Access Journal by MDPI

Conference Venue:

Hotel Mercure Warszawa Grand ****
Address: Krucza 28, Srodmiescie, 00-522 Warsaw, Poland

Editors: Saim Emin

Dominik Eder

Alla Zak

Pawel Kulesza

Polina Mladenova

Prepress and press: deja.bg

Publisher: European Nanoscience and Nanotechnology Association, Sofia 2023, Bulgaria

ISSN 2603-4239

Light-activable nanostructured platforms for biomedical applications

Filippo Pierini[a]

[a] *Department of Biosystems and Soft Matter, Institute of Fundamental Technological Research, Polish Academy of Sciences, Ulica Pawinskiego 5b, Warsaw 02-106, Poland*
E-mail: fpierini@ippt.pan.pl

Light-responsive biomaterials refer to materials that exhibit changes in their properties or behaviors in response to light stimuli.[1] These materials are designed to interact with light, enabling precise control over their physical, chemical, or biological properties. Light-responsive biomaterials have gained significant interest in various fields, including tissue engineering, drug delivery, diagnostics, and bioelectronics. They offer unique advantages due to their spatiotemporal control and non-invasive nature. More specifically, light-activable biomaterials provide the possibility to develop selective treatments by using specific wavelengths and targeting specific cells or tissues while minimizing damage to healthy surrounding tissues. These features lead even to minimal invasivity of such an approach. Moreover, the activation of biomaterials is based on the use of non-ionizing radiation, such as near-infrared (NIR) light, which minimizes the risks and side effects.

Photothermal therapy (PTT) is the most diffuse light-activated medical technique that uses photon-induced heating to selectively destroy or damage abnormal cells/tissues or pathogens in the body.[2] Photodynamic therapy (PDT) is another well-studied technique involving a light-sensitive compound (photosensitizer) administered to the patient. When activated by light of a specific wavelength, the photosensitizer generates reactive oxygen species (ROS), which can cause oxidative damage to the surrounding cells/pathogens, leading to their destruction.[3] Moreover, NIR-responsive nanoplatform made by polymers can be used as smart drug delivery systems (SDDSs) in which light irradiation regulates the temporal control of the delivery of bioactive molecules.[4] Additionally, it is worth pointing out that the development of hierarchically structured nanomaterials offers the opportunity to combine two or more of the therapies mentioned above, which profoundly enhances the effectiveness of medical treatments or diagnostic tools.[5]

During this presentation, an overview of the most recent activities performed by the Pierini Research Group will be presented, focusing on showing the development of electrospun and 3D-printed polymer-based light-responsive materials for biomedical applications.

Acknowledgements:
This work was supported by the National Science Centre (NCN) SONATA BIS Project No. 2020/38/E/ST5/00456 and the Polish National Agency for Academic Exchange (NAWA) under Bekker NAWA Programme, grant number: BPN/BEK/2021/1/00161.

References:
[1] Pierini et al., Biomacromolecules 19 (2018) 11 4147–4167.
[2] Guglielmelli et al., Adv. Photonics Res. (2021) 2 2000198.
[3] Costa et al., Macromol. Biosci. 22 (2022) 2100512.
[4] Nakielski et al., ACS Appl. Mater. Interfaces 12 (2020) 49 54328–54342.
[5] Ziai et al., NPG Asia Mater 14 (2022) 18.