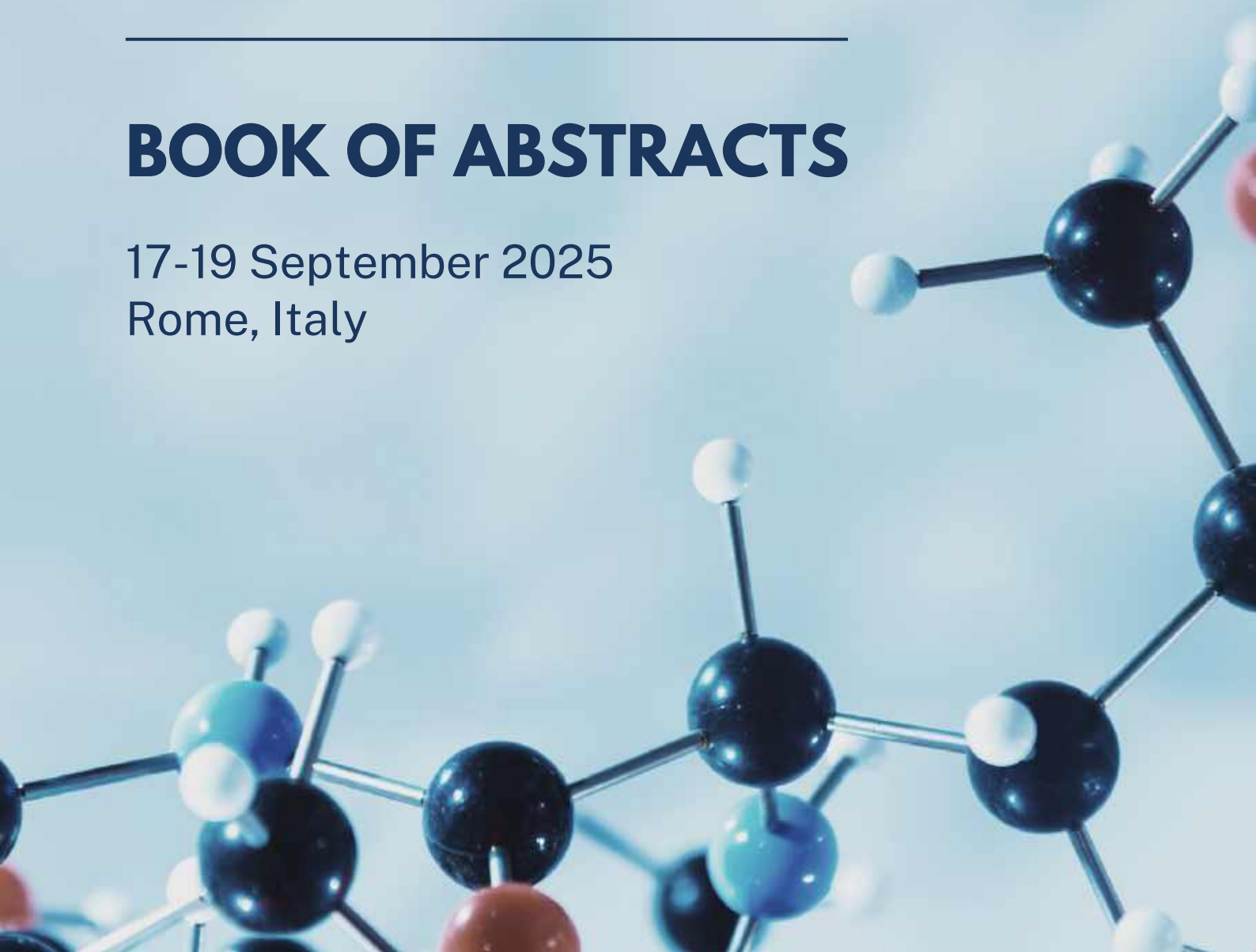
1ST POLISH-ITALIAN CONFERENCE

ON CHEMISTRY, MATERIALS AND BIOMEDICINE (CMB)

BOOK OF ABSTRACTS

17-19 September 2025
Rome, Italy



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Rome 2025

Conference Venue:

Polish Academy of Sciences – Scientific Centre in Rome
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FORMATION OF GRAPHENE/MNO_2 COMPOSITE ELECTRODES FOR A MICROFLUIDIC DEVICE FOR THE QUANTITATIVE DETECTION OF H_2O_2

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Quantitative detection of hydrogen peroxide in biochemical processes provides important information for screening oxidative stress. Microfluidic electrochemical systems make it possible to work with microquantities of biological material and determine H_2O_2 concentrations of the order of micromoles[1]. The high selectivity and sensitivity of electrodes based on MnO_2 materials have an important influence on the process. However, manganese dioxide has some disadvantages that became apparent during the work process. Due to poor conductivity, the layer of working material must be very thin and does not allow for long-term use of the chip.

The aim of this investigation is to form a graphene/MnO_2 composite as a working electrode, which will combine high sensitivity and more stable operation of the biosensor.

During work, we used graphene from ACS MATERIAL: graphene dispersion in water 1-3 μm. The reagent was diluted in water and prepared in several solutions. The material was ultrasonicated, then a drop was applied to the glass of the ITO and kept at 300 ^{0}C for 10 minutes. The surface was examined by SEM and showed that it contains graphene with some flakes perpendicular to the surface in the form of peaks. The lower the concentration of the solution, the thinner the flakes, but they do not cover the entire surface. Therefore, the optimal method for applying a graphene substrate is sequential application of three layers of graphene from a low-concentration solution. The resulting precipitate was then electrochemically coated with MnO_2 from a sulphate electrolyte, controlling its thickness.

During measurements of the catalytic activity of the obtained graphene/MnO_2 composite, a stable analytical signal with high sensitivity was obtained.

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References

[1] Poltavets, V.; Krawczyk, M.; Maslak, G.; Abraimova, O.; Jönsson-Niedziółka, M. *Dalton Trans.* **2023**, 52 (38), 13769–13780. https://doi.org/10.1039/D3DT02199H.