

# Doctoral School of Information and Biomedical Technologies

## Polish Academy of Sciences (TIB PAN)

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**SUBJECT:** Nanostructured conductive polymer-based materials for biomedical applications

**SUPERVISOR:** dr hab. Filippo Pierini, email: fpierini@ippt.pan.pl, Institute of Fundamental Technological Research Polish Academy of Sciences, ul. Pawińskiego 5b Warsaw 02-106, Poland

**DESCRIPTION:** Conductive hydrogels are a fascinating class of biomaterials that combine the flexibility and high-water content of hydrogels with electrical conductivity. This unique combination of properties makes them highly suitable for various biomedical applications, including tissue engineering, drug delivery, biosensors, and bioelectronics.<sup>[1]</sup> Material engineers focus their activities on developing biomaterials for nanomedicine-oriented applications and apply these kinds of materials to developing advanced platforms.

Conductive hydrogel has several fascinating features, including unique electrical conductivity, adequate mechanical strength, satisfactory biocompatibility, and outstanding swelling behavior.<sup>[3]</sup>

Several techniques have been involved in the fabrication of conductive polymeric biomaterials, including hydrogel; nonetheless, electrospinning stood out due to its versatility and capability to process various types of materials, creating a high degree of hierarchy and resulting in multifunctionality.<sup>[4]</sup>

The proposed PhD project aims to design and develop polymeric electrically conductive materials using various fabrication techniques, including electrospinning. The resulting nanostructures will undergo extensive studies to demonstrate their unique features and exceptional functionalities. Additionally, the project will explore the applicability of these nanomaterials in diverse biomedical fields, such as drug delivery and tissue engineering. This PhD research is anticipated to result in numerous publications in high-impact international scientific journals and presentations at international conferences.

### REQUIREMENTS

- Holding an MSc degree in Chemistry, Polymer Science, Physics, Nanotechnology or any related field of Materials Engineering
- Solid background in polymer material development (expertise in electrospinning as well as hydrogel and/or conductive polymer nanomaterial fabrication is desirable)
- Keen interest in polymer nanomaterial characterization (e.g., SEM, AFM, FT-IR, XRD, DSC, TGA, Photothermal characterization, etc.)
- Ability to design, execute, and evaluate research experiments
- Excellent collaboration skills as well as the ability to work independently
- Highly capable of communicating scientific results in English, both orally and in writing. Required documents:

## **BIBLIOGRAPHY:**

- [1] Y.Ziai et al., “*Conducting polymer-based nanostructured materials for brain-machine interfaces*”, WIREs Nanomed Nanobiotechnol. 15:e1895, 2023.
- [2] C.Rinoldi et.al. et., “*In Vivo Chronic Brain Cortex Signal Recording Based on a Soft Conductive Hydrogel Biointerface*”, ACS Appl. Mater. Interfaces, 15, 5, 6283-6296, 2023.