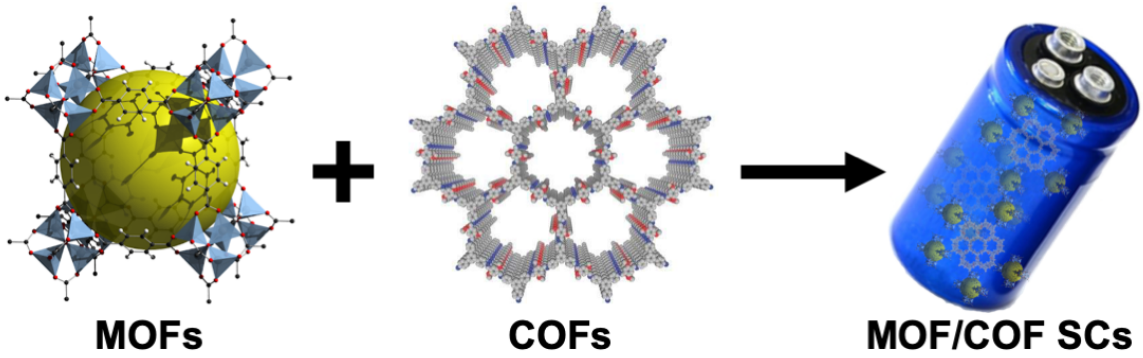
***Research aims of the project***

The main aim of the proposed research project is to design and synthesis of new type of porous hybrid materials based on metal organic (MOF) and covalent organic frameworks (COF). Synthesized MOF/COF hybrids will be consecutively integrated as the active electrode material within supercapacitors – devices for energy storage and generation. (Fig. 1)




**Rys. 1** Schematic representation of the project research objectives.

Preliminary results confirm that utilization of this kind of novel MOF/COF hybrids as the active element of supercapacitors will allow one to increase the overall energy efficiency and stability of electrode materials and the final device. It is worth mentioning that implementation of such hybrid materials in the supercapacitors is still unprecedented and highlights the novelty of this project.

***Implemented methodology***

Three main points of the projects are anticipated and will be established within the course of the project:

1) Synthesis of porous materials in the form of metal organic frameworks (MOFs) and covalent organic frameworks (COFs)
2) Integration of the above networks into porous MOF/COF hybrids via covalent and coordination bonds
3) Electrochemical studies regarding the electrochemical capacity properties, ultimately aimed at their utilization as an active part of supercapacitors.

During the course of the project detailed structural and spectral characteristics of MOF/COF hybrids and their starting materials (MOF, COF) is anticipated. To achieved this aim, the following techniques will be used and are covered below in three sections:

**Microscopy:** Atomic Force Microscopy (AFM); Scanning Electron Microscopy (SEM) with EDS detection; High-Resolution Transmission Electron Miscroscopy (HR-TEM).
**Spectroscopy:** Nuclear Magnetic Resonance (NMR); Fourier-Transform Infrared Spectroscopy (FT-IR); X-ray Photoelectron Spectroscopy (XPS); Roentgenographic X Ray Diffraction (XRD), Raman Spectroscopy.
**Others:** Thermogravimetric Analysis (TGA), Braunauer-Emmett-Teller surface area method (BET) as well as pore distribution (ASAP), Cyclic Voltammetry (CV).

***Significance of the project***

The project will allow for the knowledge expansion regarding the domain of supercapacitors and investigation of organic/inorganic subunits that influence the electronic efficiency and stability of prepared devices. It is an interdisciplinary endeavour that combines the elements of organic synthesis, materials chemistry and electrochemistry. Furthermore, international collaboration is anticipated with the prestigious Institut de Science et d'Ingénierie Supramoléculaires (ISIS, France), UdS in France, Strasbourg where PI did his PhD study and Technische Universität Dresden (TUD, Germany) one of the leading Universities in Europe in the field of engineering and nanotechnology. Presented project is also a continuation of research commenced in ISIS.