

### **Project 3.8 Design and synthesis of inorganic-organic porous materials for biomedical applications**

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#### **Background:**

The research area concerning inorganic-organic porous materials (Metal-Organic Frameworks – MOFs) has been growing dynamically over the last two decades due to their promising functional properties as well as constantly emerging more and more sophisticated applications. One of such application area involves biomedicine, where MOFs are being used in design of drug delivery systems as well as in biosensing or phototherapy. Within this area of application MOFs have been attracting increasing interest due to their easy functionalization and capabilities for tailoring the material properties for specific practical requirements.

The growing interest in MOFs has created the need for their efficient and scalable production, which was not possible using the early solvothermal methods. Therefore, a number of alternative synthetic strategies have been developed in recent years, involving: microwave-assisted, sonochemical or electrochemical methods. However, the most promising alternative to the traditional solvothermal approach appears to be the MOF preparation using mechanochemistry, which enables high-yielding processes in solid state with excellent reaction rates and minimal amount of waste. The use of a modern mechanochemical approach for preparation of bioactive MOF-based material is currently a virtually unexplored field, despite the significant scientific and application potential.

#### **Aim:**

The project aims to develop mechanochemical synthetic approaches to bioactive MOF-based materials from predesigned molecular clusters. This goal will be achieved using a rational design and functionalization of the porous frameworks based on the principles of the supramolecular chemistry. The main focus of the research work will be the development of new materials for drug-release study with particular attention devoted to the drug release triggered by external chemical or physical stimuli.

#### **Requirements:**

- MSc degree in chemistry, physics, biotechnology or related field of science
- fluency in English in writing and speech
- basic experience in inorganic synthetic methods and characterization of materials (e.g. NMR, PXRD, IR, gas adsorption)