The project is aimed on the detailed analysis of the synthesis and properties of the hybrid nanostructures, composed from the crabonized metal organic frameworks (MOF) and carbon nanotubes (CNT). Idea of the project is the application of the carbonized MOFs, composed from the metals used as a catalyst for the nanotubes synthesis, for the hybrid preparation during single process - MOF carbonization. Metal organic frameworks during the carbonization decomposed to the metal oxides or metalic nanoparticles and carbon nanostructures. A series of the processes occurred during MOFs carbonization is responsible for the metal nanoparticles oxidation and reduction, metal nanoparticles agglomeration, formation lof the secondary nanoparticle from the metal nanoparticles and carbon nanostructures degradation from the cracks and cavities formation.

Research conducted within the project aim to determine: (i) the process that occurs during the MOFs carbonization, (ii) process parameters and their efficiency analysis, (iii) developing and determination the most efficient CNT synthesis parameters, regarding the MOFs type and his structures after carbonization, and (iv) analysis of the chemical and physical properties of the obtained hybrids.

The advantage of the developed methods of hybrids synthesis and produced hybrid structures will be easier – single process carbon structures with metal nanoparticles preaparation and carbon nanotubes synthesis. So far published synthesis methods of hybrid structures, are composed by chemical binding of the carbon nanotubes with the matrix or synthesis carbon nanotubes on their surface. Typical method of synthesis carbon nanotubes on the surface of the matrix are composed from the following stages: synthesis of the core structure (matrix), functionalization core with the metal nanoparticles and CVD process of the carbon nanotubes synthesis. Proposed method of synthesis hybrid structures allows to combine functionalization of the core structure and growth of carbon nanotubes in one stage. Reduced amount of the synthesis steps with the detailed analysis of the process occurs during MOF carbonization, increases the control over the structure and properties of the hybrids.

Depending on the type of the studied MOF as a hybrid core, their surface area, pore volume and pore size may variate. Except the type of used MOF, hybrids surface area may be controlled by the length and diameter of CNT. The variety of the metal nanoparticles, both their type and chemical structure, may give hybrid structures additional magnetic, catalytic or fluorescence properties. Hybrids from the attached and grown carbon nanotubes has attract wide interest as a elements for Li-ion battery and supercapacitors, as a adsorbent and catalyst for the discolouration/liquids purification. Studies planed in the project allow the efficient synthesis wide series of hybrid composed from CNT and carbonized MOF. Conducted studies are an prelude to advanced application studies. Selected hybrids with high surface area, long CNT or with special features (from the metal nanoparticles inside carbonized MOF) will be additionally studied as a adsorbent and additionally functionalized in order to give them catalytic performance.