Novel MOP-polymer and MOF-polymer hybrid networks as effective materials for destruction of toxic pollutants.

The release of toxic pollutants into the atmosphere, which include products of chemical reactions (e.g. combustion), accidental release of harmful industrial gases and vapors as well as the deliberate emission of chemical warfare agents, are risks of growing concern. Volatile organic compounds (VOCs) are considered a major group of air pollutants. The European Union defines VOCs as chemicals with a vapor pressure greater than 10 Pa at 293 K, which may lead to smog, carcinogenesis, teratogenesis and mutagenesis. A particularly harmful class of VOCs are the Chemical Warfare Agents (CWAs), although banned since 1997 by the Chemical Weapons Convention, they are easily available to terrorists, unscrupulous governments, and still are a worldwide threat. These concerns have accelerated the search for novel air-filtration technologies for the capture and/or eventually the catalytic degradation of harmful gases and **VOCs** into environmentally benign molecules. Many efforts have been made to develop effective chemical protective materials against them. Especially, the development of lightweight and wearable fabrics that can rapidly catalyse the elimination of CWAs is highly desirable.

Porous materials are of paramount importance in minimizing the undesired effects of human activity by means of increasing the efficiency of industrial processes and giving rise to remediation processes. These porous materials can be regarded as “chemical sponges”, which can selectively trap and neutralize toxic pollutants, thus preventing their release to the environment. In this context, two classes of crystalline porous materials known as **metal organic frameworks (MOFs)** and **metal-organic polyhedra (MOPs)** have been attracting unabated attention in research and development. These porous, ordered structures have found use in variety of applications including gas storage, separation, catalysis, biomedicine, and more. There are virtually unlimited possibilities to create new MOF structures since the building blocks of MOFs are inorganic clusters and organic linkers. Moreover, we can design the structure and properties of MOFs for selected applications. Unfortunately, a huge barrier to wide application of MOFs exists due to their low processability. In contrast, **organic polymers** are characterized by excellent plasticity, which allows to tailor the form of the material to specific applications. However, the combination of MOF structures with flexible polymers is a challenging task for materials chemists, due to the inherent difference in surface properties of these two groups of materials.

Is it possible to combine two materials with very different properties? Scientists are constantly working on creating new groups of hybrid or composite materials with unique properties.

In this project, a new strategy for obtaining **MOP-polymer** and **MOF-polymer hybrid networks** is proposed, which allows for permanent binding of organic polymers to the surface of MOP and MOF materials. The main goal of this project is the design and synthesis of original multifunctional hybrid materials for selective trapping and neutralization of toxic pollutants (harmful gases and **VOCs**).

The production of new and more uniform functional materials for more efficient applications is crucial for the development and integration of new and socially acceptable scientific technologies. In this view, the proposed studies will produce knowledge that may lead to novel materials that are uniquely effective for environmental and societal protection. We believe that the proposed research has clear economic and environmental implications, and potential to benefit society.