One of the priority tasks of modern chemistry is to satisfy the growing needs of new materials with specific properties and to cover the constantly increasing energy requirements. The manufacturing processes needed for this must be based on principles of "Green Chemistry", and should not produce harmful byproducts and waste heat. They should be efficient and run with low energy demand. The aim of my research is to synthesize new inorganic-organic hybrid materials with photocatalytic properties. These materials will consist of metal oxides (eg. TiO_2, ZnO) and a carbon support (eg. Starbon®, biochar). The metal oxides are applied to the surfaces of the support using a sol-gel method assisted by ultrasound (Fig. 1).

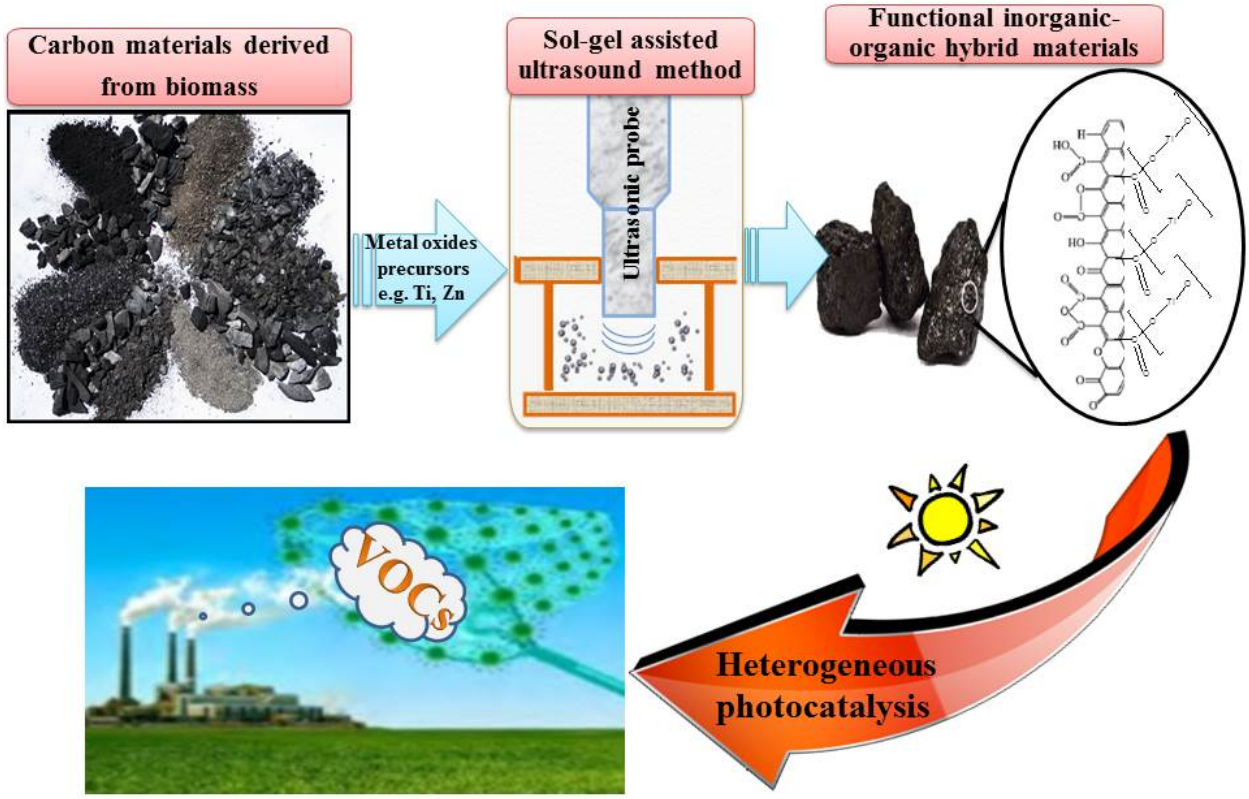

Fig. 1 Diagram of the planned research project involving the synthesis of functionalized inorganic-organic hybrid materials for photocatalytic oxidation of VOCs

"Starbon ®" represents a completely new group of porous carbon materials obtained from cheap material derived from biomass. I assume that the resulting materials will be characterized by specific photocatalytic properties, thanks to the specific and unique characteristics of their components and appropriate interaction. The carbon materials derived from biomass have very interesting properties, due to the presence of various functional groups on the support surface, which depend on its pre-treatment (eg. sonication, preliminary heat treatment). These functional groups can potentially react in different ways with precursors of metal oxides, leading to hybrid nanomaterials, which have different physicochemical properties. Additionally, modulation parameters of preparation will allow us to investigate more carefully this process and to determine its optimal conditions in the preparation of highly efficient photo-active materials. In addition, our proposed model oxidation test reaction of volatile organic compounds (VOCs) will provide an understanding of more in-depth as well as a multi-faceted knowledge about the processes associated with the transformation of these types of compounds with inorganic-organic hybrid material with photocatalytic properties. It is now widely known that the VOCs represent a direct threat to human health and the environment by toxic effects as well as through indirect impact, leading to the formation of harmful secondary pollutants, eg. ozone.The threat posed by volatile organic compounds to the environment, and thus for the man himself, illustrates the fact that they constitute up to 60% of all air pollutants, and among carcinogenic compounds contained in the inventory emissions of toxic compounds (Toxic Release Inventory - TRI), they account for as much as 73% of all the compounds included in this list. According to world literature reports in indoor air were identified about 500 compounds belonging to the group of volatile organic compounds.Some of these compounds is attributed to, or proven disease activity (especially mutagenic or carcinogenic), but many of them are suspected of causing the so-called non-specific symptoms such as lethargy, headache, dry the eyes, throat and skin, sometimes tearing and so. "wet" nose, inability to concentrate, which are called sick building syndrome (Sick Building Syndrome - SBS). People who suffer from Sick Building Syndrome, also complain of discomfort on the overall environmental (Environmental Discomfort).