Opis popularnonaukowy po angielsku

Heterosilsesquioxanes that are the subject of this project, are a specific class of silsesquioxanes (**POSS**), the organosilicon compounds of the general formula **$[RSiO_{3/2}]_n$,** forming three-dimensional structures based on siloxane skeleton surrounded by organic functional groups. The inorganic-organic character of POSS, modified with organic groups attached to the silicon atoms, has essential influence on the properties of materials obtained from them, e.g. on solubility, flammability, mechanical strength, thermal resistance or chemical resistance. The compounds of this type are used as nanofillers and modifiers of nanocomposites and as ligands in metal complexes allowing formation of models of heterogeneous catalysts.

The world demand for materials showing a variety of specifically defined properties has been the background drive for the research intended within the project. Our study will focus on the synthesis of functionalized heterosilsesquioxanes and their further application in catalytic reactions leading to low- and high-molecular precursors of materials and characterization of the products obtained. A feature distinguishing heterosilsesquioxanes from the other POSS is the presence of heteroatoms in their structure which is responsible for certain physicochemical properties. According to literature, introduction of different elements into the structure of a given compound molecule substantially affects the physicochemical properties of materials including this compound, often endowing it with unique parameters which predestines them for specific applications.

The main aim of the studies planned is the design of effective and selective methods for the syntheses of heterosilsesquioxanes comprising in their structure reactive functional groups that are capable for further modification by catalytic and non-catalytic pathways, towards formation of unique low- and high-molecular structures containing elements from 13-15 groups of the periodic table (in particular **B, Ge, Sn, P, Sb**) directly incorporated into the product structure.

Within the project these new compounds will be comprehensively characterized, their reactivity and physicochemical properties will be determined. The idea is not only to learn about their chemistry but also to initiate development of a new branch of functionalised heterosilsesquioxanes as potential precursors of new advanced materials. The outcome of the research work planned in the project will be a new catalogue of compounds for further material studies and for application studies.

The project goes beyond the currently realised studies of heterosilsesquioxanes that have been focused on the structures without reactive functional groups. The presence of these groups that are capable of modification by a number of catalytic transformations, permits obtaining materials of new generation containing different p block elements. The project is meant to be a milestone for development of this group of compounds that can inspire generation of new materials followed by application studies.