In recent years, the object of vast interest of many research groups and one of the fastest growing areas of silicon chemistry are polyhedral oligomeric silsesquioxanes (POSS). They form a large class of chemically and structurally well-defined inorganic-organic materials which due to their size and three-dimensional structure of silicon-oxygen core makes them a good part of hybrid systems.

An important element is the search for newer materials and efficient methods of their functionalization, which will stand out against the background of the currently known and applied systems both in terms of properties, structure, and thus further applications. Optimizing the properties of organic semiconductors is a main step for improving the performance of e.g. organic light emitting diodes, organic photovoltaic systems, transistors and other electronic devices. Combination of organosilicon structures such as silsesquioxanes with organic semiconductors can enable synthesis of new, efficient and resistant materials with defined structure and well-examined properties that can revolutionize optoelectronics in the future. POSS with various functional groups such as vinyl can open up the possibility to synthesize even more complex materials with multiple transport and emitting groups with minimal synthetic output. POSS with different functional groups such as vinyl can open up the possibility of synthesizing even more complex materials with multiple transport and emitting groups with minimal synthetic output, and their efficient and selective synthesis can significantly influence to the wider possibilities of practical use of such molecules.

The aim of this project is to synthesize a new class of incompletely condensed silsesquioxanes which contain three vinyl functional groups protruding from the cage and then their functionalization with arylsilanes. The obtained POSS derivatives will be functionalized by hydrosilylation reaction using synthesized arylsilanes, including chromophore derivatives which are used to produce blue light-emitting diodes. There will be obtained branched systems and molecular capsules in which POSS will be a kind of molecular scaffold. This will allow us to propose a whole range of compounds that will vary among themselves the construction of the silsesquioxane fragment, the arrangement of chromophores and their structure which will have a significant impact on their properties. In addition, the full characteristic of products will enable to recognize and define the connection between the structure of silsesquioxanes (e.g. the type of inert groups in the framework, the type of silicon substituent in the functional group) and chromophores (e.g. their arrangement, structure) and physicochemical and spectral properties allowing in the future to design of macromolecules with desirable properties. The final result of the project will be the inorganic-organic molecules with potentially interesting properties.