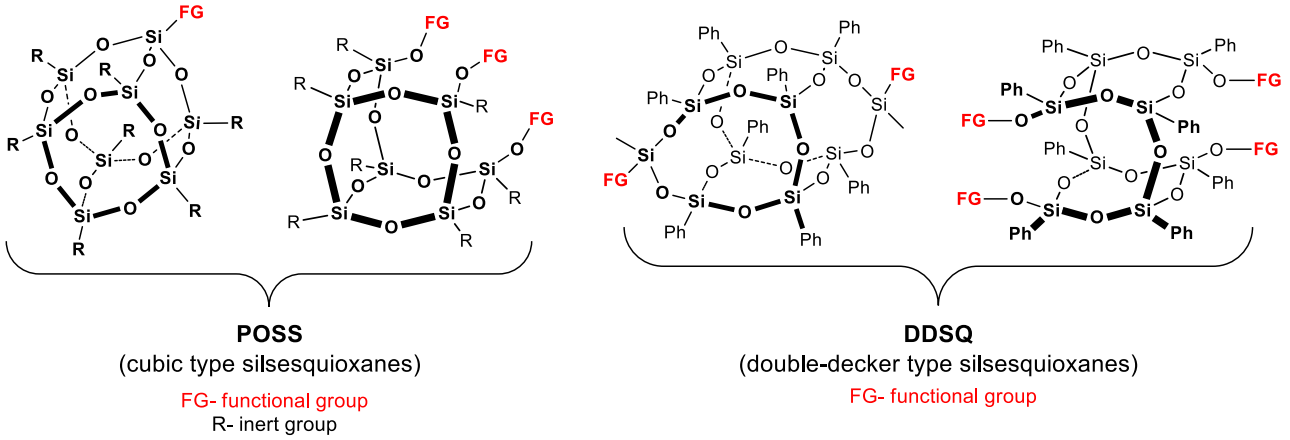
New hybrid materials based on polysiloxanes modified with silsesquioxanes

Organosilicon compounds are of great interest and have been investigated for almost seven decades which is reflected in the growing numbers of papers and patents published each year. These systems, due to their hybrid (i.e. inorganic-organic) nature, offer development of advanced, multifunctional materials, owing to combination of organic and inorganic segments. Polysiloxanes (PS), thanks to their unique properties, have found numerous examples of applications in almost every branch of chemistry and in everyday life, i.e. automobile industry, space and solar applications, optoelectronics (OLED's), drug delivery systems, food industries, cosmetics and many more. Perspectives for PS are profoundly connected with modification of their structure with a variety of chemical compounds, to obtain materials with tailored properties. Silsesquioxanes are worldwide known organosilicon derivatives with nanosize structure and specific properties, e.g. thermal stability, oxidation resistance and non-toxicity. They are applied, i.a. in material chemistry (nanofillers and modifiers of polymers), in the synthesis of advanced materials for medicine and biochemistry (tissue engineering, drug delivery systems, dental applications, biological sensors), optoelectronics and batteries, etc.

In literature, reports on modification of polysiloxanes with silsesquioxanes are limited (in comparison to other modifiers and carbon-based polymers). Hence, the purpose of the project ***"New hybrid materials based on polysiloxanes modified with silsesquioxanes"*** is to design and synthesize new types of hybrid materials that are based on polysiloxanes and silsesquioxanes as their modifiers. The crucial aspect of this project is to investigate the influence of the wide range of silsesquioxane frameworks incorporated into the resulting hybrid materials structures on their physical and chemical properties which are also planned to be thoroughly verified.



Scheme 1. Selected structures of Silsesquioxanes

The proposed project will be realized in three main work steps. The first part is devoted to the design and synthesis of alkenyl-functionalized silsesquioxanes. They will be used for modification of polysiloxanes (PS) which will result in obtaining a new type of hybrid polymeric materials and will be the second stage of the project. The advantages of postulated synthetic procedures to achieve this goal lie not only in exploitation of new POSS and DDSQ silsesquioxanes but also in the elaboration of appropriate catalytic systems (i.e. reaction type and catalyst). The last part of the project is to subject all the modified polysiloxanes to a thorough characterization that helps to answer the question on the matter of their structure and unique physic-chemical properties.

The expected results of this project contribute to the extension of knowledge on the methodology for functionalization of polysiloxanes with silsesquioxanes and result in the synthesis of new hybrid materials of unique architecture and interesting physical properties as highly specialized materials, so-called "*fine-chemicals*". In recent years, the number of reports on the synthesis of hybrid materials with variety of applications has been growing rapidly, however, it still meets unknown perspectives.