DESCRIPTION FOR THE GENERAL PUBLIC

Hydrosilylation reaction, which involves the addition of organic or inorganic silicon hydrides across multiple bonds in particular carbon-carbon (in alkenes and alkynes) or carbon-heteroatom (carbon-oxygen, carbon-nitrogen) bonds, is an efficient method for the formation of silylated compounds, which can be further used in the synthesis of *fine chemicals* and silicon-based materials. The stereoselective formation of desired products predominantly demands the use of a catalyst, which accelerates reaction rate and leads to the formation of specific isomers. Transition metal molecular complexes are still the most used catalyst in hydrosilylation reactions that occur in homogeneous conditions. The catalyst reuse and recycling, easy separation methods of products from the catalyst as well as the sustainability of the whole process are the most challenging tasks in modern organosilicon chemistry.

The goal of the project is to deal with these problems by the application of supercritical CO_2 ($scCO_2$) as a reaction solvent, which due to its unique properties can be used for development of new catalytic systems for repetitive batch and especially continuous flow hydrosilylation. A combination of $scCO_2$ with the molecular catalyst, its way of immobilization leading to effective separation strategy is responsible for effective hydrosilylation processes. The project will be focused on understanding the process in all scales: *molecular* (interactions between catalyst, solvent, and reagents), *mesoscale* (development of effective separation strategy) and *macroscale* (the whole process scheme with the inline monitoring of its progress).

The hydrosilylation of alkynes, imines and carbonyl compounds in $scCO_2$ with the application of catalyst immobilized in ionic liquid deposited on a solid support (SILP) or nanoparticles will be carried out for the first time. The understanding of the whole reaction engineering and development of the repetitive batch and continuous flow processes based on the information gained in all process scales are the main objectives of the project. The research carried out within the project will create a new approach to hydrosilylation processes, which can proceed under repetitive and especially continuous flow mode. Taking care about the process sustainability, economy, efficiency and stability is one of the most important tasks of innovative processes.

The cooperation between both scientific units ITMC RWTH (Germany) and CAT AMU (Poland), their complementary knowledge, experience in sustainable processes with continuous flow catalysis on the one hand and catalytic synthesis of organosilicon compounds on the other, will build a hub for new organosilicon technologies of the 21st century, according to the fundamental research carried out in the project leading to detail process understanding. The project goes beyond the currently realized studies on methods used for hydrosilylation, catalyst immobilization and the strategies for its recycling, and application of $scCO_2$ as a solvent for batch and continuous flow synthesis.