Obtaining durable hydrophobic surface is an emerging problem, especially when very thin and transparent layer of organic or inorganic origin is needed for protection of light sources, solar panels, (photo)catalysts and dyes dispersions. Use of commercially available amphiphiles, i.e. substances possessing both hydrophilic (water soluble or miscible) and hydrophobic (water repelling) comprising one (macro)molecule, like surfactants and some polymers, is not sufficient in this field because the obtained layer may be easily washed out by organic solvents or even water. The abovementioned phenomenon may occur if the amphphilic substances are not sufficiently anchored to the surface. It should be emphasized that even very slight changes in the structure of the amphiphilic compounds may result in complete failure of their usefulness. Taking into account that mentioned compounds are produced in relatively low quantities, the process of their synthesis has to be carefully optimized. The abovementioned strategy utilizes novel engineering approach - Process Analytical Technology (PAT), comprising direct determination of important parameters, e.g. temperature, concentration of particular compounds, directly during the manufacturing process. Moreover, planning of experiments in a systematic and structured way allows to understand the cause-effect relationship in processes between dependent and independent variables, making it the most effective method of problem solving in process engineering. In particular, the use of Design of Experiment (DoE) allows a process engineer to effectively acquire knowledge and use this knowledge to achieve innovation and high quality product, through planning and making the best decisions during process optimization. Linear and branched silicone surfactants are known for their exceptional properties, in comparison to traditional surfactants, especially ability to lower surface tension of aqueous solution below ca. 20 mN/m, excellent emulsifying action as well as stabilization of aqueous dispersions. Therefore, the mentioned chemicals gain attention, especially in the fields that traditional surfactants exhibit inferior performance, e.g. surface hydrophobization (i.e. making it water-repelling) as well as preparation of stable dyes or pigments dispersions. In order to provide sufficient stability of surfactants' layer at the surface / interface there is a need to perform appropriate reversible or irreversible cross-linking (i.e. multiple network – forming reactions) between the amphiphilic molecules. Here we propose to synthesize, optimize and carefully study the performance properties of novel class of amphiphiles, i.e. reactive silicone surfactants. This group of novel fine chemicals is intended for surface / interface hydrophobization in the fields of dyes or pigments solubilization or entrapment, and protection of light sources or solar panel with thin and stable water-repelling layer. The proposed amphiphiles comprise reactive groups, e.g. epoxide ring, double bond in vinyl or acrylate moiety, within hydrophobic fragment, between hydrophobic and hydrophilic groups as well as inside polar fragment. These approaches are suggested in order to assume appropriate reactions in colloidal systems or at the surface / interface. The novelty of the proposed studies also comprises formation of ionic bonds between surfactants' molecules during the abovementioned processes. Importantly, it is planned to design the surfactant's structures, their manufacturing conditions as well as post synthesis treatment (polymerization / step-by-step reactions) utilizing semi-industrial manner with great perspective for upscaling. All critical parameters and reaction progress will be assessed by continuous flow FT-IR, enabling direct collecting of the spectra during the reaction. Full control of the technological parameters (e.g. pH of solution, temperature, pressure, quantity and dosing rate of the reagents) will allow getting the critical information about process that influence the product quality. In particular we plan to utilize Response Surface Methodology (RSM) enabling more accurate modeling of the process around the optimum region for a given technological process in a graphical way (3D graphs). Utilizing RSM a large amount of information can be generated from a relatively small number of experiments, and the optimization of reactions and processes can be done in a much shorter time. The proposed plan develops technologies combining at least few requirements of "green technology" (i.e. more environmentally friendly). Such methodology is conceptually new and may provide the significant contribution to rapidly developing technologies, combining fine chemicals and surface / disperse systems engineering, as well as to solve problems with durability of hydrophobic layers and dispersions in both aqueous and solvent-borne systems. Moreover, use of process engineering approaches, including PAT, DoE and RSM, enables finding critical process parameters, optimizing conditions and properties of the obtained products and, therefore, easy upscaling.