Supercritical fluids as reaction media and as solvents for extractions

The participants in the advanced module will get a general overview about processes in which supercritical carbon dioxide is used as a solvent, co-solvent and as a synthesis media. The phase diagrams of the fluid will be illustrated, as well as a short experimental demonstration of the phase changes from sub- to supercritical conditions of the CO_2 will be done. The advantages of supercritical CO_2 as solvent vs the common used organic solvents will be also explained. In addition to the theory experiments with supercritical CO_2 as reaction media and co-solvent will be done. During the experiments silica ionogels will be synthesized. Silica ionogels are porous materials with an intrinsic hybrid character, in which the ionic liquids are confined in a solid – like matrix. Therefore the ionogel features derive from the combination of the properties of the ionic liquid and the component forming the solid network. These materials have found applications in areas of optical and electrochemical sensing, solid state electrolytes, etc. The most common method for the synthesis of silica ionogels is the sol-gel route. During this process two chemical reactions occur – hydrolysis and condensation. The gelation time of the ionogels depends on many factors like silica source, solvent, catalyst, temperature, nature of the ionic liquid etc. Also the properties of the final product are depending not only on the synthesis conditions but also on the aging time and drying procedure. During the advanced module the participants will become familiar with the one step sol-gel process. The influence of the synthesis conditions on the gelation time of silica ionogels will be also demonstrated. Two type of synthesis will be performed – a classical one under atmospheric pressure and under high pressure in presence of supercritical CO_2.