

***Inorganic-organic hybrid materials with controllable physicochemical properties for membrane separation***

The project is an example of basic research, leading to innovative methods of the preparation of materials with controlled separation and transport properties, intended for membrane separation of liquid mixtures (e.g. by membrane distillation and pervaporation).

Membrane is a barrier that separate two phases. Thanks to its composition and morphology, and using appropriate driving force (mechanical, chemical or electrical), the selective transport of chosen mixture components can occur. The attempts of the membrane modification are a source of the permanent inspirations for many researchers. The existing membrane materials are modified using various approaches, leading eventually to the improved separation and transport properties.

The formation of materials with controlled properties is very important issue from the application point of view. Thanks to that, it is possible to choose the appropriate materials for specific/advanced applications, e.g. which will show the required resistance to wetting with water or other solvents, or resistance to abrasion and scratches. Controlling of mentioned features can be carried out by attaching (e.g. using the chemical reaction) suitable molecules (e.g. silanes) to the surface of material like inorganic ceramics. It should be emphasized that in order to produce materials with controlled properties, it is necessary to know in detail how the modifying compounds are attached to the substrate as well as to gain as much information as possible about the inorganic substrate. Moreover, the character of surface material is also very important parameter (e.g. hydrophilic – absorbing water or hydrophobic - resistant to wetting).

The research project will design and produce the innovative hybrid (organic-inorganic) separation materials with controlled material properties. The authors will focus on controlling physicochemical properties (e.g. resistance to wetting by water and other liquids / solvents) and tribological (related to mechanical resistance of prepared materials - resistance to abrasion) as well as improving transport and separation properties. Furthermore, an essential goal will be to learn and understand the mechanism of modification (functionalization) accomplished under different experimental conditions. Prepared innovative materials will be tested in separation processes - membrane distillation and pervaporation for the purification of water from micro-pollutants or removal of volatile organic compounds from water. An interesting part will be associated with the immobilization of enzyme to the ceramic substrate and learn how such modification will have influenced the material properties.

An important element of the project will be dissemination of its results not only in the form of scientific publications or conference presentations, but also in a form of lectures for general public e.g. during science festivals, open doors days, or as popular publications in the local press and using the opportunities offered by Internet access.