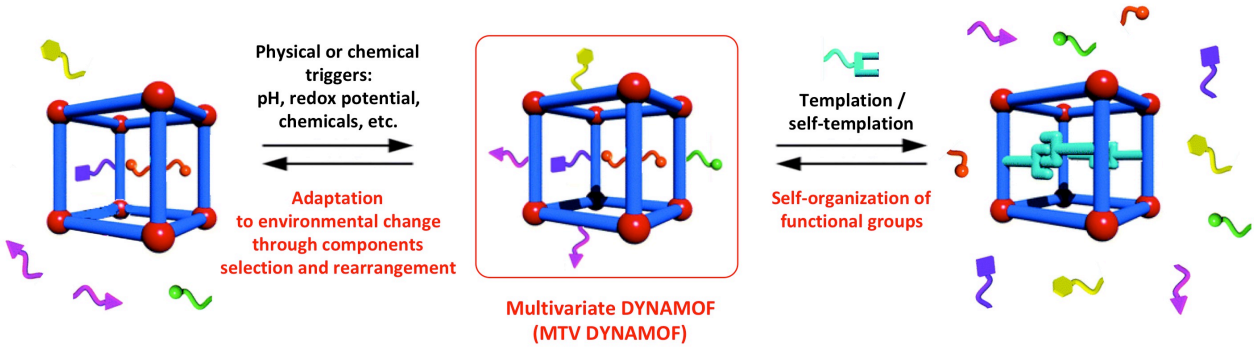
Description for the general public

The ultimate goal of this planned research project is the development of a new class of smart porous materials (DYNAMOFs) that can self-construct under the influence of their environment. At the atomic level, the materials will have a framework structure made up of rigid organic linkers connected by metallic nodes and containing nanometre-sized empty spaces. The organic linkers in these frameworks will be designed in such a way, as to allow them to reversibly bind with small molecules bearing various functional groups. Their quantity, type and spatial distribution in the material will determine its properties.



Thanks to the reversibility of the bonds between the frameworks and the functional groups, i.e. thanks to the fact that under certain conditions the bonds might form and break quickly, the functional groups might be easily exchanged for other, while preserving the structure and integrity of the framework. The ability to easily exchange or reorganise their components will give these materials adaptive properties: depending upon external conditions they may spontaneously incorporate or expel some of their building blocks, changing in this manner their composition, properties and functions.

The potential applications of such ‘magic’ materials are vast: the construction of sensors for explosives and other dangerous substances, carriers for controlled drug release, novel catalysts and many others. Translating the above into their potential value for society, these smart materials may mean better public safety (detection of explosives and other dangerous substances, etc.), more efficient and less toxic drugs, more effective production processes and many other potential benefits. Pointing out the role of scientific research, Edward Teller once said: ‘The science of today is the technology of tomorrow’. Accordingly, the outlined project not only pioneers a new and promising branch of fundamental research, but also makes one more leap into the future by developing viable routes towards novel smart materials. Thus, the outcomes of the project will be of great value for fundamental science as well as of great potential for commercialised applications in industry.