

For many years, molecular structure in the solid state has been associated with rigidity and an inability or reluctance to change, as evidenced by the famous words of the Nobel Prize laureate in chemistry Prof Leopold Ružička, who was quoted that ‘a crystal is a chemical cemetery’. As it has turned out in recent years, this is not entirely true, quite the opposite, actually. Crystals live a life of their own and undergo changes that may be elusive to the eye of the observer without the use of appropriate equipment. An opened bottle of ethyl alcohol placed near a crystal can cause collective movements of the molecules enclosed in the crystal unity and lead to a completely new configuration. The crystal can therefore be perceived as some kind of molecular kaleidoscope that responds to external stimuli. We already know that molecules, despite spatial limitations, can undergo significant shifts or rotations in the crystal, changing both the molecular and crystal structure. When does this process take place? What kind of starting requirements must be met for the molecules that make up the crystal to decide to wake up from their dormant state? This is what we would like to find out by implementing this project. Its first stage will cover the synthesis of selected macrocyclic compounds, which are characterized by considerable flexibility. The proposed compounds are new and require the development of new synthetic pathways. This task will be undertaken by a foreign partner, Prof. Wim Dehaen (KU Leuven, Belgium), who specializes in organic chemistry. The second part of the project, involving the study of collective movements of molecules occurring in crystals of the obtained macrocyclic compounds in response to the action of various external factors, will take place at the Nicolaus Copernicus University in Toruń. By using modern equipment with X-rays, insight into the depths of the crystals will be obtained, and systematic in-situ research will be carried out to explain the mechanism of action of non-porous molecular crystals responding to external stimuli. Due to the fact that they can undergo reversible changes, which can translate, for example into changes of optical properties, they are an ideal basis for obtaining sensing systems.