

To produce organic nanostructures with precisely defined physical properties, we need methods that allow their creation with atomic precision, atom by atom. One of such methods is on-surface synthesis. Thanks to the selection of appropriate molecular precursors, it became possible to produce nanostructures such as graphene nanoribbons, graphene flakes or more complex 2D networks (e.g. metal-organic networks). The surface synthesis procedure assumes that the reaction is induced on the atomically clean surface of the selected crystal. Most often, these are the surfaces of noble metals such as gold, silver or copper. We choose these surfaces because they are easy to prepare in ultra-high vacuum conditions (and these are the conditions in which we conduct experiments). However, the most important argument is that these surfaces catalyze the necessary surface reactions that allow the synthesis of organic nanostructures. To observe the reactions and nanostructures, low-temperature scanning tunneling current microscopy (LT-STM) is an ideal technique. It allows to track with extraordinary precision (single atoms) what is happening on the surface. Additionally, it allows for local probing of the electronic structure of the measured objects, i.e. on its basis we can say what physical properties the nanostructure has. Unfortunately, the above-mentioned metallic surfaces have their drawbacks. One of them is that the nanostructures interact strongly with the surface itself, which significantly disturbs its properties. This distorts the measurements and makes it very difficult to measure the exact properties of the organic systems themselves. A one solution is to use semiconductor substrates. Here, however, there is a fundamental limit. Tunneling current microscopy requires that the sample being conductive. As we know, semiconductors have a band gap, which means that the LT-STM capabilities on the surfaces of such crystals are severely limited. However, there is another type of surface. These are the surfaces of special devices, called low-dimensional devices. The name low-dimensional has a reason. The upper, active layers of such an device are often a single (in the sense of one atom thick) layer of a selected material (most often graphene). These devices have the structure of a FET (Field-Effect Transistor) transistor. Thanks to this, they have a unique property that no other bulk crystal substrate has. Through electrical gating, it is possible to change the chemical potential for the active layer (2D material). This makes it possible to induce physical states that are unavailable for bulk crystals (we can induce e.g. electronic correlations, where electrons behave like atoms in the crystal lattice). The aim of the presented project is to integrate organic nanostructures with various interesting physical properties with low-dimensional devices. Thanks to this, it will be possible to influence the electronic structure of nanostructures by using the device. An important aspect is that the planned low-dimensional devices are compatible with scanning tunneling microscopy. Thanks to this, we will be able to track the behavior of organic nanostructures on a 2D device with atomic precision.