1. Objective of the project

Project titled: "2D functional materials beyond graphene: *top-down* approach towards chemically modified MXenes" has two main objectives: **developing organo-modified MXenes and their use in applications such as gas or humidity sensing.**

2. Research to be carried out

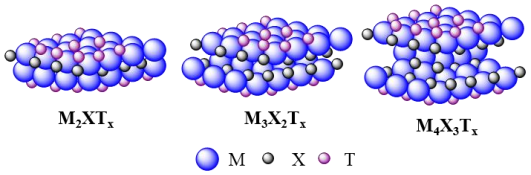

Figure 1. Schematic structures of MXenes, where M is an early transition metal, X is C and/or N, and T is –OH, -F, -O groups

The development of environmentally friendly novel (nano)materials displaying technologically relevant physicochemical properties represents a key research endeavor of many industrial and academic researchers from various field of science including nanoscience and nanotechnology. MXenes are group of two-dimensional early transition metal carbides and nitrides with general chemical composition $M_{n+1}XT_x$, where M is an early transition metal, X is C and/or N, and T is –OH, -F or –O groups. In order to synthesize organo-functionalized MXenes, first preparation of MXenes will be carried out by chemical etching of various MAX phases following by exfoliation process. Then, the organo-functionalized MXenes will be performed by attaching various organic compounds by making use of different functional groups, for example –OH that are present on the surface of MXenes after leaching process. These steps will lead to obtain novel materials, which are expected to possess different physicochemical properties compared with MXenes The obtained structures will be characterized by various advanced techniques, including microscopic, spectroscopic and others.

3. Reasons for choosing the research topic

So far, there are only few reports on the use of organic compounds employed for the modification of MXenes. Moreover, those compounds and their organic-modified counterparts are poorly studies in sensing. The international collaboration between Adam Mickiewicz University in Poznań and the group of Professor Paolo Samorì in prestigious Institut de Science et d'Ingénierie Supramoléculaires (I.S.I.S., University of Strasbourg, France) that focused on the synthesis and application of two-dimensional materials, will allow to labor new, save and fast synthesis strategies leading to obtain organo-modified MXenes. Furthermore, those novel materials will be investigated as gas and humidity sensors that allow to fabricate a new low cost, flexible and miniaturized devices, that allows to obtain a wide range of important information that can be useful for nanoscience and nanotechnology. The implementation of planned research methodologies will contribute to the knowledge of nanoscience and nanotechnology community and will allow to synthesis a wide range of novel, innovative materials with wide range of application.