

The main aim of this project is related to investigation of electronic properties of two dimensional hybrid materials. We will use allegory to describe main goals and motives behind the proposed research. This will allow us to do that in the simplest possible way. In order to understand the subject of our research, first of all, one should imagine what two dimensional materials and their hybrids are. Different two dimensional materials can be seen as sliced food ingredients e.g. a slice of cheese, ham, tomato, cucumber, a leaf of lettuce and a slice of bread. Each of these ingredients is characterized by its unique taste if eaten separately. However, the taste of a sandwich made of these ingredients will be far different – much deeper and complete. The sandwich is here a synonym of the hybrid material.

It is extremely important to realize that the taste of the sandwich cannot be exactly determined before it is tried even if the taste of each ingredient is known. We learn during our lives which composition of ingredients in the sandwich fits best our own personal taste and we create recipes which allow us to reproduce it. Moreover, we are able to modify the recipe in order to create a new taste. This is the central problem of the proposed research i.e. creating sandwiches characterized by requested taste based on the knowledge gained in the past and deep understanding of ingredients.

Currently, we know the taste of separate ingredients but we have just started to learn how to create sandwiches and how they taste. Thus, it is important to understand how different tastes of different sliced ingredients should be combined in order to design a sandwich characterized by requested taste. This project tends to shed some light on this problem, therefore, we will investigate how the taste of separate ingredients influences final taste of the sandwich. To make it clear we decided to investigate two types of sandwiches, each one composed of two ingredients: tomato on bread and lettuce on bread. The most important aspect is related to bread whose taste we would like to control by adding caraway-seeds.

In the first phase of our experiments we would have to check if bread with caraway-seeds can be sliced. Next, we will undertake systematic investigations of tomato and lettuce sandwiches' taste in function of caraway-seeds concentration in the bread. In particular, we want to show that sandwich taste can be controlled even by addition amount of caraway-seeds. We will attempt to estimate in what way the taste changes. Moreover, we will investigate in what way tomato and lettuce determine the final taste of the sandwich. We believe that results of our investigation will help in future to design sandwich taste if only the taste of individual ingredients is known.

The above description is based on the allegory in which bread corresponds to bismuth, caraway-seeds to antimony, bread with seeds is Bi-Sb alloy, tomato is graphene and lettuce corresponds to MoS₂. The taste corresponds to electronic properties.