

Our main objective is to develop method of synthesis of free-standing conductive nanocomposite films comprising of a single layer and two layers of gold nanoparticles cross-linked through chemical bonds. Structures composed of two layers are often referred to as the “sandwich-like” ones, and – in this case – will be composed of two layers of nanoparticles separated by a layer of organic molecules. For our purposes, we will employ gold nanoparticles of the diameter of about 5 nanometer. They will be connected by molecular “bridges” consisting of molecules coating the surface of the nanoparticles – ligands – and the cross-linking molecules – linkers – capable of binding on two ends with the ligands. These molecular bridges will be able to conduct electric current. molecules capable of conducting electric current.

To carry out the synthesis we will adapt and develop the method of fabrication of cross-linked monolayers of gold nanoparticles that has recently been elaborated in the research group of PI. According to our best knowledge, there are no other techniques allowing fabrication of this type of material. Investigation of the electrical conductivity of the nanostructured films to be synthesized allows one to gain an insight into the mechanism governing charge transport in the nanoscale. Transfer of electrons in two-dimensional networks through the –ligand-linker-ligand bridges spanning freely between adjacent nanoparticles has not yet been investigated. The obtained nanostructured films could also be employed as sensors of mechanical distortions, caused by very small motions of gas or fluid, offering an attractive alternative for the conventional sensors based on the piezoelectric phenomenon.