Following project aims at a deeper knowledge of the physical-chemical aspects of the stability of the surface layers of molecules on the functionalized Au / GaN surface and the relationship between their fluctuations and the ability to bind other molecules in the nano-pores Au / GaN. The understanding of these processes is crucial from the point of view of development of sensors based on Au / GaN. The project will investigate the effect of dynamics of molecules on the surface which is being bound on and ligand exchange process which is taking place between the surface and the liquid phase of self-assembling layers of molecules with thiol groups. One of the key issues examined will be the answer to the question of whether the resulting layers are "populated" in a manner proportional to the amount of molecules in solution and if the processes of deposition of multiple layers of molecules and intercalation with a π-stacking molecular interactions take place driving Au/GaN functionalization. The study will show how molecular structure (its geometry, and geometry presence of functional groups) influences the time-resolved and thermal stability of the layers. The results will enable to describe whether and how the exchange between the particles on the surface, and ones in the solution is strengthen or weaken by aforementioned factors it. In addition, following the hypothesis is going to be verified does high pressure cause infiltration of the surface layer particles by other molecules. These studies provide information on does particle and surface interaction look like and if the surface particle can interact with others in the solution via intermolecular forces. The optimum coverage of the sensor will be determined by results analysis. It will allow to obtain self-cleaning surface of sensor which enables in vivo research to be performed. Together with it, there will be developed a layer being able to adsorb molecules from the solution which will increase sensitivity of sensor furthermore. The use of high pressure for the intercalation of molecules may become innovative research technique for examining molecules which have not yet been able to adsorb on the surface of the sensor. Above mentioned problem was undertaken in order to further optimize, improve and develop SERS platform based on photo etched gallium nitride. These platforms are an novel diagnostic tool featuring stability and a high enhancement factor. The proposed work will allow further development of this type of sensors for biomedical applications.