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# Molecular self-assembly on surfaces

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## Abstract

The aim of the present research is to study the interaction of biomolecules, among them single amino acids, on metallic and mineral surfaces, and their chemical reactivity by means of powerful surface science techniques. Therefore, the use of simple biomolecules gives fundamental and significant information, including an adequate control of biomolecule-surface interactions, which will be unattainable to develop with more complex molecules. Furthermore, these studies are focussed on the catalytic properties of different surfaces that could be involved in molecular self-organization processes and the formation of prebiotic organic compounds.

## 1. Introduction

Understanding the chemical interaction of molecules on surfaces provides fundamental information on prebiotic chemistry process. Due to its simple structure, amino acids can be used as a good model system to study biomolecule-surface interactions, which can assist in the understanding of more complex systems. Also, it has been found that a number of amino acids self-organize to form well-ordered two-dimensional structures at metal surfaces.

On the other hand, it is important to explore the role-play by different surfaces related to prebiotic chemistry processes such as adsorption, concentration, stability, self-organization and self-assembling of molecules. Furthermore, we will explore the catalytic properties of different surfaces that could be involved in the molecular network formation between amino acids and then to test the chemical reactivity of these molecules on catalytic surfaces. Therefore, to study the interaction of single amino acids on surfaces and their chemical reactivity, we will use complementary and powerful surface science techniques.

## 2. Experimental

These studies have been developed under ultra high vacuum (UHV) clean environment working conditions, then, it will be possible to use several complementary *in-situ* surface science techniques such as X-ray Photoemission Spectroscopy (XPS), Reflection Absorption Infrared Spectroscopy (RAIRS), Scanning Tunnelling Microscopy (STM), Low Energy Electron Diffraction (LEED) and Temperature Programmed Desorption (TPD) for the characterization of molecular interactions on surfaces. Furthermore, a comparison studies between molecule-surface systems under UHV and chemisorption from solutions have been performed, in order to approach more realistic bio-systems.

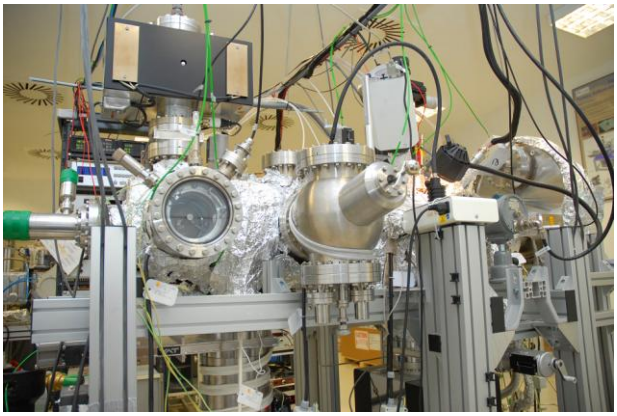

Figure 1: Spectroscopies and microscopies on surfaces chamber.

## 3. Summary and Conclusions

By the complementary use of several surface science techniques we obtain understanding on molecule/surface system, which includes information about the self-assembly of amino acids on surfaces and the chemical state of the adsorbates depending on different experimental conditions like molecular coverage or pH [1,2] and therefore atomic models to improve our understanding of molecular self-organization and chiral processes.

We have reported diffusion and long-range order processes of the single amino acid on surface driven by the formation of stable electrostatic interactions between adjacent molecules [3]. Finally, we explore the catalytic properties of different surfaces that could be involved in the molecular network formation between amino acids. These studies are based on an innovative approach; complementary studies of ultra high vacuum multitechniques will be focus for the understanding of nano-molecular systems, which have great relevance nowadays on prebiotic chemistry. In summary, we describe molecular self-organization process and the chemical reactivity of these molecules on surfaces, to improve our understanding of interface process in prebiotic chemistry reactions.

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