SYNTHESIS AND CHARACTERIZATION OF MIXED MONOLAYERS ON HYDROGEN-TERMINATED SILICON SURFACES.

Rogero C[1,2], Hong Q[2], Horrocks B[2], Houlton A[2], Mateo-Marti E[1], Briones C[1], Martín-Gago J A[3]
(1) Centro de Astrobiología (CSIC-INTA), Madrid, Spain
(2) Chemical Nanoscience Laboratories.University of Newcastle upon Tyne, Newcastle, United-Kingdom
(3) Instituto ciencia de materiales de Madrid (CSIC), Madrid, Spain
crogerobc@inta.es

Construction of self-assembled molecular layers on surfaces is one of the most important subjects not only for fundamental science but also for a wide range of applications. The most studied system is the self assembled monolayers of alkanethiols on various metals, especially on gold. It is clear, however, that deserve importance to construct ordered molecular layers on semiconductor surfaces. In this sense, Si is the most important semiconductor substrate for organic layer formation at present, because the wide range of possible applications in conjunction with the advanced silicon technology. There has been increasing interest in the molecular fuctionalization of bulk silicon surfaces through reactions with the hydrogen-terminated layer. Our work extends the range of silicon modification to include mixed monolayers controlling the immobilization process.

We focus our study on the absorption of mixed monolayers at hydrogen-terminated silicon surfaces by thermal reaction of alkenes. We have combined different silicon surfaces, porous Si and Si(111) single crystal, different molecules to mixed, octyl (C_8), undecyl (C_{11}), undecenyl aldehyde ($C_{10}CHO$), and undecanol ($C_{11}OH$), and different experimental techniques in order to fully characterize these mixed monolayers. The combination of Fourier transform infrared and Synchrotron Radiation X-ray photoelectron spectroscopies reveals that the resulting molecular films present a composition that is representative of the composition of the solution.

On the other hand atomic force microscopy gives us information about the structure and resistance for the layers prepared in every stage of the inmobilization process. AFM images show that lateral diffusion and/or desorption-readsorption of the adsorbate is very small. These well-mixed monolayers at silicon surfaces are convenient for the separation of active sites by a simple dilution method, and therefore they possibility the control of the mean spacing between reactive groups on a surface through simple solution chemistry. This procedure shows itself as a useful method for nanoscale surface design [1].

References:

[1].- Qi Hong, Celia Rogero, Sanna Hakkarainen, Bernard A. Connolly, Jeremy H. Lakey, Eva Mateo-Marti, Carlos Briones, Jose Angel Martin-Gago, Benjamin R. Horrocks, and Andrew Houlton. in press Phys.Chem.Chem.Phys.