

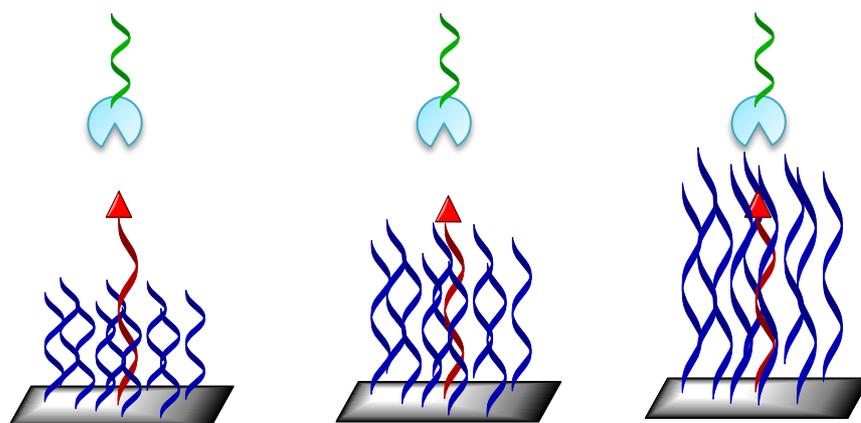
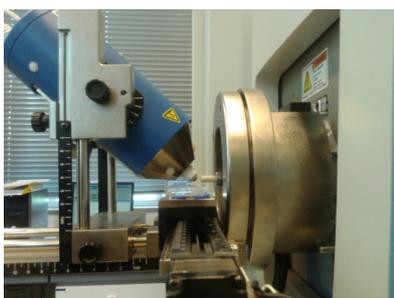
Group : Active Organic Surfaces
Project : **Throwing DARTs at the surface**
Supervisors : Han Zuilhof

Introduction

The foundations of organic chemistry have over the last century and a half nearly fully been discovered in solution. We learned a great deal (e.g. about the activation barriers), but recently it becomes more and more clear that on a surface molecules react differently, largely because of entropic reasons. This is of great importance, since the ongoing miniaturization of devices implies that the surface and its reactivity become more and more important. However, it is much more difficult to study reactivity on a surface, as neither 'mopping up' (e.g. column chromatography) nor routine approaches (structure elucidation by NMR) are available. In addition, rationalizing entropy is also more difficult than entropy. In the period 2011-2016 we have therefore developed a method that is easy to use and highly powerful to analyze surfaces: DART-MS. In this, mass spectrometry is used via a special ionization tool (a DART – size of a can of Coke, but 25 k€ in price) that allows study of surfaces.

Following a highly successful series of measurements (leading to 2 Angew Chem papers in 2017) we will study a range of "click reactions", in which we will prepare functionalized organic monolayers, and study their reactivity by looking at (1) selectivity (2) product composition, (3) reaction conditions, and (4) effect of the microenvironment (including the height of the surrounding molecules – in Figure below: the height of the blue alkyl chains surrounding the red triangle that represents a reactive functional group). The study will also make use of other surface characterization techniques, such as, XPS, IRRAS, SCA and AFM. Strange but true: for almost all surface-bound reactions (1) to (4) is hardly known..

We utilize cheap and readily available surfaces like aluminum and modify them with functionalized phosphonic acid (say by an azide) and react it with an incoming molecule. By the end of the project, the student comprehends and can handle surface modifications and is able to follow the reactivity (wanted or unwanted) of the monolayers by various different methods. IN addition, hands-on mass spectrometry skills will be further developed.



Information

If you are interested in this topic please feel free to send a mail to:
Han Zuilhof han.zuilhof@wur.nl
