SAMs of 11-MUA grown on polycrystalline Au-foils by physical vapor deposition in UHV

P. Frank, F. Nussbacher, J. Stettner, A. Winkler

Institute of Solid State Physics, Graz University of Technology, Austria
E-mail: Paul.Frank@TUGraz.at

Abstract. In the present study, our aim was to prepare and characterize 11-mercaptoundecanoic acid (11-MUA) films on polycrystalline Au-foils grown by physical vapor deposition (PVD) in ultra high vacuum (UHV). When preparing the SAMs by PVD in a UHV chamber, one profits from well defined conditions and exclusion of the influence of air. The Au-samples were cleaned in UHV by Ar-sputtering. In order to characterize the 11-MUA films, mainly thermal desorption spectroscopy (TDS) was applied. TDS measurements revealed monolayer and multilayer desorption. A variety of different masses was observed when desorbing the 11-MUA from the Au-surface. This showed on the one hand the cracking pattern of this molecule in the quadrupole mass spectrometer (QMS) and on the other hand that reactions took place during the adsorption/desorption process. Of particular interest was the question as to the Au-S and the C-S bond breaking.

1. Introduction

Self assembled monolayers (SAMs) consist of a single layer of ordered molecules on a substrate. These molecules consist of a functional end group, a spacer group (backbone) and a terminal anchoring unit. A SAM is formed due to the interplay of the anchor-substrate interaction and the lateral interaction of the molecules. SAMs have several applications in scientific research [1-3], which utilize in general the possibility to modify the surface properties and to perform structuring and contact printing, which can be used for novel organic devices. The desired SAM can be grown by immersion in solution or by physical vapor deposition (PVD) in ultra high vacuum (UHV). Most frequently, SAMs are grown by immersion in solution because the SAM preparation and the change of the functional end group (chemical tailoring) is easier to perform this way. The advantage of preparing the SAMs in UHV by PVD is obviously a cleaner substrate surface and the possibility to utilize surface science methods to characterize the grown SAMs. A frequently used prototype system is organothiols on gold. Apart from the customary functional end group, they consist of a terminal sulfur group and an organic backbone.

There exists a large number of literature on SAM formation and characterization in general [1,3-5] and on functionalized alkane thiols in particular [6-8]. The most frequently used methods to analyze the SAMs are Scanning Tunneling Microscopy (STM), Infra-red spectroscopy (IRS), X-ray absorption spectroscopy (NEXAFS) and Low Energy Electron Diffraction (LEED). In this contribution we will focus on the application of Thermal Desorption Spectroscopy (TDS). This