

TUNING THE PROPERTIES OF MOLECULAR ORGANIC LAYERS AT THE MICRON-SCALE USING LOW-ENERGY ELECTRONS

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Self-assembled monolayers (SAMs) have been widely used in nanotechnology because of their flexibility of functionalization [1,2]. Irradiation using high energy particles is one of the methods used to tune the SAM chemistry to fit specific applications. This type of irradiations provides less control over specific induced chemical modifications due to the numerous reactions that are competing at these energies. On the other hand, irradiations using low-energy electrons (≤ 50 eV) provide a way to regulate the type of chemical modifications induced within the films [3,4]. Molecular thin layers in the form SAMs of p-terphenylthiol HS-(C₆H₄)₂-C₆H₅ (TPT) deposited onto gold will be considered as an illustrative example. They are organized surface-confined monolayers of aromatic compounds, often used to develop sensors [1] and functionalized carbon nanomembranes [5]. The global chemical modifications undergone by these layers under electron processing were observed to be strongly dependent on the incident energy in the range 1-50 eV, mostly using High Resolution Electron Energy Loss Spectroscopy (HREELS) [6]. Special emphasis was put onto their hydrogen contents and on their sp²-hybridized carbon center contents. To tune the electronic properties of the molecular platforms at the micron-scale, we have used monochromatic, highly collimated low-energy electrons to write microscopic chemical modifications in TPT layers in a Low Energy Electron Microscope (LEEM) [7-8]. The chemical modifications induced locally for different irradiation doses and energies lead to the design of work function [9] templates in TPT self-assembled monolayers.

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