Spontaneous growth of 2D Molecular Lamellar Crystals

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Molecular self-assembled monolayers (SAMs) have been extensively used to engineer inorganic–organic surfaces in electronics and more recently in molecular spintronics where ferromagnetic (FM) electrodes and organic materials are combined together.[1]

Recently, we have been working on SAM functionalization of FM surfaces. We have developed a method to recover an already oxidized high T_c FM surface just before the molecular deposition.[2] Thus, we functionalized Co, and permalloy (Py, a Ni:Fe alloy) with alkanethiol molecules (CnSH, n = 12, 14, 16, 18). Contact angle, X-ray photoelectron, and Infrared spectroscopies confirmed the successfully organized grafting of the thiol molecules.

Compared to prototypical alkanethiol SAMs on Au, which results in stable and smooth films, Atomic Force Microscopy (AFM) revealed that when our SAM functionalized FM surface is exposed to the air, lamellar island-like domains are formed over the FM surface within some hours (Figure 1a-d). These domains appear under the AFM as layered structures where the step-height depends on the length of the grafted molecule. Some alkanesulphur-metal lamellar materials have been reported before as bulk solids or surface bound materials under low pressure and high temperature.[3] However, real-time imaging of their growth under ambient conditions is completely unprecedented. Based on those previous reports, AFM characterization and local spectroscopic data we propose the structure depicted in figure 1e for the CnS/FM system.

References

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Figures

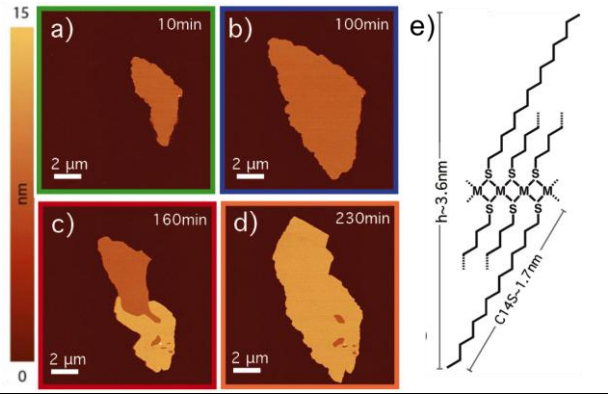

Figure 1: (a–d) Topographic AFM tapping images showing the realtime evolution of a C14S island on Co and (e) proposed structure of a single C14S/Co layer