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The self-assembly of halogenated molecules on the Si(111) √3×√3-Ag surface

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The development of organic analogues of graphene, the only known 2-d conjugated polymer, would represent a new class of materials [1]. One approach to the formation of covalent organic frameworks (COF) is the adsorption of halogenated aromatic precursors onto atomically ordered surfaces, followed by de-halogenation, and subsequent covalent coupling. Although examples of COF formation on single crystal metal surfaces have been described, very limited work has been done to explore formation on semiconducting surfaces. Recently, we have reported that the Si(111) √3×√3-Ag can provide an inert, high-mobility template suitable for the adsorption of halogenated organic molecules [2].

In this presentation we discuss the room temperature adsorption of a halogenated organic molecule, 2,4,6-tris(4-iodophenyl)-1,3,5-triazine (TIPT), onto the Si(111)-√3×√3-Ag surface studied by scanning tunneling microscopy (STM) in ultrahigh vacuum. We find that at low coverage TIPT monomers remain intact and display high mobility on the √3-Ag surface. At low coverage many STM images show evidence of diffusing species on the surface. In fact, this evidence is often manifest as parallel "*fuzzy*" lines on the √3-Ag terraces. With increasing molecular dose the monomers form supramolecular domains defined by a 2.0 nm by 1.8 nm rectangular cell. The size and symmetry of the unit cell provides strong evidence that the monomers do not undergo de-halogenation, and that the dominant interaction within the domains is intermolecular I···H hydrogen-bonding. As the coverage approaches one monolayer, the molecular film is a mixture of supramolecular domains separated by disordered regions. In addition to our results at room temperature, we will discuss preliminary experiments on the affect of annealing.

1. D.F. Perepichka, and F. Rosei, *Science323***, 216–217 (2009).
2. R. Liu *et al.*, *Surf. Sci.647***, 51–54 (2016).

Primary authors: Mr LIU, Renjie (Lakehead University); Mr MARCHESE, Davide (Lakehead University); Mr SUFFAK, Mark (Lakehead University); Mr GENESH, Navathej (Indian Institute of Science Education and Research (IISER), Pune); Ms FU, Chaoying (McGill University); Dr MOISEEV, A. (McGill University); Prof. PEREPICHKA, Dimitrii (McGill University); Prof. GALLAGHER, Mark (Lakehead University)

Presenter: Prof. GALLAGHER, Mark (Lakehead University)

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