Cross-shaped islands of salt on graphite: A study by Ultra High Vacuum Scanning Probe Microscope (UHV SPM)

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NaCl on graphite is an interesting system as sodium chloride is an insulator and graphite is counted as a semimetal. The properties of such kind of systems could be intriguing. But the challenge is to grow thin films of NaCl on huge atomically flat terraces of graphite. The experiment studies the structures of salt on graphite that are grown by diffusion limited aggregation [1] and compares it with KMC simulations [2]. The effects of growth kinetics and thermodynamics of the system are studied as well.

In this experiment we deposit predefined amount of sodium chloride on cleaved graphite and observe the morphology of the structures thus formed using a UHV SPM. The structures are cross-shaped and are quite stunning. All these crosses display a two tier cross section which has a two monolayer base at the bottom and a one monolayer cap on top of it. The branching pattern of these crosses (Figure 1) are peculiar and at first they appear to be oriented at right angles to each other (a cross with four arms) but with addition of more sodium chloride molecules the branching starts to change to five arm and six arm star shapes, due to an inter-play between the flux of the deposition and surface free energy anisotropy of the system.

The long term goal of this project is to obtain thin layers of salt on top of a substrate. This salt layer would then support metallic or semi-metallic nanoparticles on top of it. The configuration would allow nanoparticles to be studied by Scanning Tunneling Spectroscopy (STS). The presence of an insulating barrier partially decouples the electronic states of the nanoparticles or the nanostructures from the underlying substrate and provides a clear picture of the electronic properties of the material.

References: