Identifying passivated dynamic force microscopy tips on H:Si(100)

S. Jarvis[1] P. Sharp[1] R. Woolley[1] A. Sweetman[1] L. Kantorovich[2] P. Moriarty[1]

[1]School of Physics and Astronomy, University of Nottingham, Nottingham NG7 2RD, U.K.
[2]Department of Physics, King's College London, The Strand, London, WC2R 2LS, U.K.

The Si(100)[1] surface is a particularly attractive system for the study of single atom/molecule chemistry. When terminated with a passivating layer of hydrogen (Si(100):H), isolated chemically reactive sites can be fabricated by removing a single hydrogen atom allowing interactions to be studied within a unique environment. Particularly interesting information can be obtained via the technique of nc-AFM, which allows the forces and energy of interaction to be measured between molecules and surfaces. Although well studied in STM, thus far only a single nc-AFM image of the Si(100):H surface has been published[2]. We will discuss a nc-AFM study of the Si(100):H surface[3] which elucidates the different force interactions responsible for image contrast. In particular, we observe an inverted imaging contrast thought to originate from atomically repulsive force interactions. Force-distance spectroscopy will also be presented and compared with the results of density functional theory simulations. From these comparisons we provide key insights into the characterisation of the tip-sample system, which may have important consequences for molecular imaging as well as for the fabrication of single chemically reactive sites.

[1] Sweetman et al., *Phys.Rev.Lett.* **106**, 136101 (2011).
[2] Yokoyama et al., *Jpn. J. Appl. Phys.* **39**, L113 (2000).
[3] Sharp et al., *Appl. Phys. Lett.* In submission (2012).