Deuteration of C_{60} on Highly Oriented Pyrolytic Graphite surface

G. Pantazidis[1], J. D. Thrower[1], M. Scheffler[1], P. A. Jensen[1], L. Hornekær[1, 2]

[1]*Department of Physics and Astronomy, Aarhus University, 8000 Aarhus C, Denmark,*
[2]*Interdisciplinary Nanoscience Center (iNANO), Aarhus University, 8000 Aarhus C, Denmark*

gpantazidis@phys.au.dk

In interstellar space the surfaces of nanoscale dust grains provide the opportunity for surface reaction routes to e.g. hydrogenation. Buckminster Fullerenes - C60 - has been observed in the interstellar space, in regions near hot stars [1]. The hydrogenation of C_{60} and subsequent strain induced unzipping has been proposed as a route to form Polycyclic Aromatic Hydrocarbons [2], which are observed to be ubiquitous in interstellar space where they are proposed to act as catalysts for H_2 formation [3]. Hydrogenated C_{60} has been investigated in gas phase experiments [4], and various mechanisms of C_{60} fragmentation and unzipping after an increasing degree of hydrogenation have been proposed. Theoretical *ab initio* studies suggest that the strain on the molecule increases after the addition of about 36 hydrogen atoms on the C_{60} molecule [5]. However relevant experimental investigations of hydrogenation of C_{60} on interstellar dust grain analogue surfaces along with the necessary theoretical support are still lacking.

In this poster we present an experimental study of the deuteration of C_{60} adsorbed on Highly Oriented Pyrolytic Graphite (HOPG), an analogue of interstellar carbonaceous dust grain surfaces. Dosing of C_{60} was performed for 10 minutes on HOPG held at a temperature of 360K, resulting in the growth of a few layer film. Subsequently, keeping the sample at the same temperature, the C_{60} film was exposed to a flux of D-atoms with a temperature of 1800K. Scanning Tunneling Microscopy (STM) measurements were performed to investigate the adsorption structures of the adsorbed pristine and deuterated C_{60} molecules. STM images show the growth of C_{60} islands in the first case and the deuteration of C_{60} molecules in the latter. Temperature programmed desorption (TPD) measurements were used to identify the different species existing on the surface through mass spectrometry. The TPD data reveal an increasing degree of deuteration, as evidenced through the desorption of higher mass species, with increasing D-atom fluence. Additionally, the data show a cut-off for deuteration beyond the mass of $C_{60}D_{36}$, while a peak in yield is present at a mass corresponding to the species $C_{60}D_{18}$.

References:
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