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Superhydrogenation of PAHs through interaction with hydrogenated grain surfaces

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The formation of molecular hydrogen, H_2, in the ISM is thought to primarily occur on dust grain surfaces. This process has been investigated extensively through a variety of experimental and theoretical approaches for several different model grain surfaces. More recently it has been suggested that PAHs, representing the molecular limit of the carbonaceous grain population, can act as catalysts for H_2 formation through the generation of superhydrogenated PAH, or HPAH species (Rauls & Hornekær 2008). In addition to interaction with gas-phase hydrogen atoms (Thrower *et al.* 2012), our laboratory measurements have shown that adsorption of PAHs on hydrogenated graphitic surfaces can also lead to the formation of HPAHs through the pick-up of adsorbed H-atoms that are bound to the graphite surface (Thrower *et al.* 2014). Whilst mass spectrometry provides evidence for the formation of HPAHs through this mechanism, the exact hydrogen adsorption sites occupied remains unclear. Scanning tunneling microscopy (STM) provides us with the ability to probe the adsorption and hydrogenation of PAHs at the micropscopic level. Using coronene $C_{24}H_{12}$ as a prototypical PAH molecule, we show that a variety of hydrogenation structures are formed following adsorption on a hydrogenated HOPG surface. We also demonstrate how the surface temperature affects the hydrogenation process, which depends on the ability of the adsorbed coronene to scan the surface in order to pick up the adsorbed hydrogen atoms.

References

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