Non-aromatic nature of carbonaceous species formed in the conditions of circumstellar environments of evolved stars

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Carbonaceous dust particles can be produced in the laboratory by diverse experiments; however, the majority are based on uncontrolled combustion or plasma decomposition of molecular precursors in conditions far from those in evolved star photospheres. We have designed and built an unprecedented ultra-high vacuum machine combining gas aggregation sources [1], with a chemistry starting exclusively from gas-phase C atoms and molecular hydrogen combined with advanced *in-situ* surface-science characterization techniques. We obtain dust analogs that consist of amorphous C nanograins and small C-clusters, aliphatic in nature with a low degree of hydrogenation. Our results suggest that aromatic species are not efficiently formed by gas-phase chemistry in circumstellar environments but could be generated after thermal processing of the C-clusters on grain surfaces. The combination of laboratory astrochemistry and surface science with astronomical observations can unveil new chemical routes that can operate in different cosmic environments, and provide new insights into the chemistry of carbonaceous dust formation.

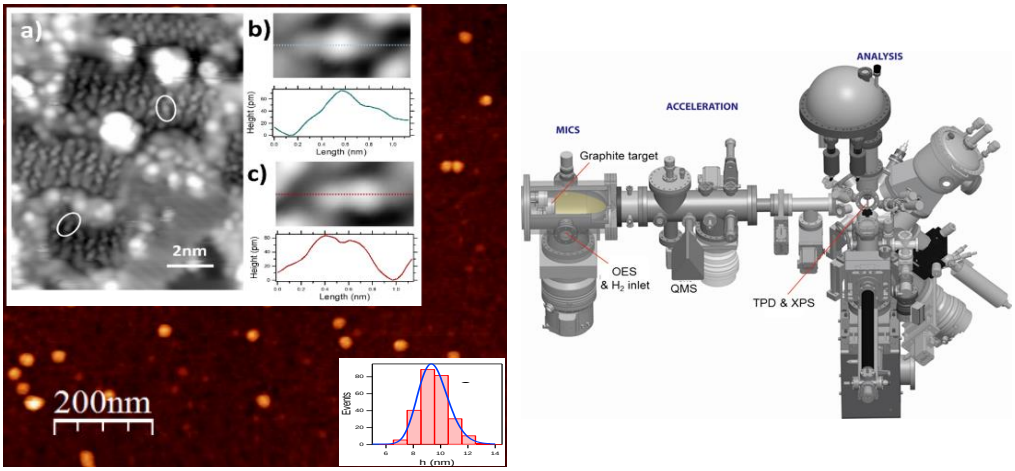

Figure 1: Left: STM and AFM images of C-nanograins and C-clusters collected on a surface. Right: technical drawing of the "Stardust" configuration used in the experiments.

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References: [1] L. Martinez *et al.* Sci. Rep. **8**, 7250 (2018)