Probing the impact of the C/O ratio and metals on the properties of dust particles in a cold plasma reactor

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The formation of dust in the envelopes of evolved stars is still poorly understood. Nucleation theories and thermodynamic models predict two main different dust families depending on the C/O ratio in the envelope. C-rich stars would lead to carbonaceous nanograins possibly including polycyclic aromatic hydrocarbons (PAHs) whereas O-rich stars would lead to oxide or silicate nanograins. Our aim is to get insights into the impact of the C/O ratio and the presence of metals on dust properties. To that end we carry experiments in a cold plasma reactor to generate dust analogues and perform *ex-situ* molecular mass analysis of the collected dust.

The advantage of experiments in plasma reactors is that one can play on the gas-phase chemical composition by using different gas precursors and also, in our case, sputtering of a metal target to release metal atoms in the plasma gas phase [1]. More specifically we use an axially asymmetric radiofrequency argon discharge with pulsed injection of hexamethyldisiloxane (HMDSO, $C_6H_{18}OSi_2$) that contains key elements present in the envelopes of evolved stars. This configuration allows to study the impact of two specific parameters on the dust formation: -(i)- the C/O ratio by enriching the mixture with oxygen by O_2 injection and –(ii)- the metal atoms by sputtering of Ag and, currently, Fe.

To probe the impact of the C/O ratio and metals, we investigate the molecular composition of the collected dust using the AROMA (Astrochemistry Research of Organics with Molecular Analyzer) set-up. The instrument combines laser desorption/ionisation, in a single or two-steps scheme, with an ion trap mass spectrometer [2]. Diagrams are built from the obtained mass spectra and some first considerations on chemical pathways are provided.

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References

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