LINKS BETWEEN SILICATES AND ORGANICS IN IDPs: LABORATORY SYNTHESES OF THEIR ANALOGS

Z. Djouadi, R. Maupin, R. Brunetto, Louis d'Hendecourt, IAS, CNRS, UMR- 8617, Université Paris Sud, bât. 121, F-91405 Orsay Cedex, France. E-mail: zahia.djouadi@ias.u-psud.fr

Introduction: The Chondritic Porous Interplanetary Dust Particles (CP-IDPs) are assumed to be the most pristine extraterrestrial particles available in the laboratory for studies with high spatial resolution analytical techniques. Using infrared micro-spectroscopy we performed systematic analyzes on nearly thirty IDPs, from which 12 were found to be anhydrous (considered the most primitive ones). Our study of these 12 anhydrous IDPs focused on the two main components, namely the organic component and the mineral one. It revealed a correlation between grain mineralogy and the length of associated aliphatic carbon chains i.e. olivine-rich IDPs have longer aliphatic chain lengths than pyroxene-rich ones [1]. By combining Raman micrsospectroscopy analyses we proposed that these two families of IDPs would result from pre-accretionnal processes, we had discarded the effects of secondary processes on the parent bodies. This study raises the question of the link between the two phases (mineral and organic) and possibly the role played by minerals in the synthesis and/or evolution of organics on the surface of small bodies of our solar system.

Experiments and Results: Using the MICMOC (Matière Interstellaire et Cométaire, Molécules Organiques Complexes, -- i.e. Interstellar and Cometary Matter, Complex Organic Molecules) setup [2, 3], we produced organic residues by UV irradiation of astrophysical ice analogs on olivine substrates. The synthesized samples are then analogous to the most commonly accepted cosmic dust model proposed by Greenberg in 1968; a grain consisting of a solid silicate core and carbon compounds, entirely coated with ice (volatile compounds). This model traces well the evolution of the dust in the interstellar medium: the silicate solid dust ejected by the stars at the end of their lifetime penetrates in the dense clouds, where the gases condense on their cold surfaces to form a mantle of dirty ice. These molecules undergo irradiation by UV photons and cosmic rays inducing the formation of more complex species made of simple molecules (H_2O, CH_3OH, CO, NH_3..). The ice may then subsequently heat up to leave an organic semi-refractory residue as indeed observed in the laboratory simulation.

For these experiments we used two samples, an amorphous thin film of olivine composition deposited on a KBr window as described in Djouadi et al. [4]. The second sample is a KBr pellet in which we incorporated crystalline olivine powder. We used a mixture of H_2O, CH_3OH and NH_3 in relative proportions of 3:1:1 at low temperature ~ 77 K. The UV irradiation was performed along with the deposition of the ice on the substrates, ensuring a full penetration of the UV photons within the forming ice layer. The duration of this step is about 4 hours. Infrared spectroscopy is used to monitore the experiment. The first obtained results, we will present, are promising, they reveal a slight difference between the residues synthesized on the two different substrates (amorphous and crystalline olivine). We will also show the 3.4 µm feature of the residues' spectra compared to what is generally observed in the IDPs as well as to what is observed. in the source SgrA toward Galactic Center.

References:

[1] Merouane et al. (2014) *The Astrophysical Journal* 780:174. [2] Nuevo et al. (2003) Astrophysics of Dust, Estes Park, Colorado, May 26 - 30, Edited by Adolf N. Witt, meeting abstract, id. 158. [3] De Marcellus et al. (2017) *Monthly Notices of the Royal Astronomical Society*, 464, 114. [4] Djouadi et al., (2005) *Astronomy and Astrophysics* 440, 179–184