Organic samples produced by ion bombardment of ices for the EXPOSE-R2 mission on the International Space Station

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We describe the preparation and characterization (by UV-Vis-IR spectroscopy) of a set of organic samples, stable at room temperature and above, that are part of the experiment "Photochemistry on the Space Station (PSS)" planned to be enclosed in the EXPOSE-R2 mission, which will be conducted on the EXPOSE-R facility, outside the International Space Station (ISS). The organic materials are prepared in the Catania laboratory after 200 keV He+ irradiation of icy mixtures, namely N_2:CH_4:CO deposited at 16 K on MgF_2 windows furnished by European Space Agency. It is widely accepted that such kind of materials produced by energetic processing are representative of organic material in astrophysical environments such as, e.g., comets. Once expelled from comets these materials are exposed to solar radiation during their interplanetary journey before they eventually land on the Earth and other planetary objects where they might give a contribution to the chemical and pre-biotical evolution. In particular our residues contain different chemical groups, including triple CN bonds that are considered relevant to pre-biotic chemistry (e.g. Palumbo et al., 2000). Therefore the samples will be exposed, for several months, to the solar ultraviolet photons that are a major source of energy to initiate chemical evolution in the Solar System. This will allow analysis of their destruction and evaluation of their lifetime in the interplanetary medium. The samples have three different thicknesses (about 200, 130, 65 nm) that will allow the estimation of the depth profile of destruction (e.g., Baratta et al., 2002). This experiment overcomes the limits of ground tests which do not reproduce exactly the space parameters.

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References: Baratta G.A., Leto G., Palumbo M.E.: A comparison of ion irradiation and UV photolysis of CH4 and CH3OH, A&A, 384, 343, 2002; Palumbo, M.E., Strazzulla, G., Pendleton, Y.J., Tielens, A.G.G.M. ROCN species produced by ion irradiation of ice mixtures: comparison with astronomical observations. ApJ 534, 801, 2000.