Photoluminescence Measurements of the EURECA organic residue : Does it match the ERE?

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Organic residues are thought to be a candidate for grain mantle materials and they have been shown to produce a close match to the observed interstellar 3.4μm absorption feature. The dust grains that produce the 3.4μm absorption feature are also thought to produce the Extended Red Emission (ERE). ERE is a broad emission band with a peak wavelength between 610 nm and 850 nm depending on the astrophysical environment, such as reflection nebulae, planetary nebulae, and the interstellar medium (ISM). If there is a connection between the 3.4μm absorption feature and ERE, then this organic residue should also photoluminesce with a peak wavelength in the range 610 nm $\leq \lambda \leq$ 850 nm.

Photoluminescence (PL) measurements have been obtained for a laboratory organic residue that has been exposed to long-term solar ultraviolet radiation aboard the EURECA satellite. Excited by a 488 nm Ar laser, the photoluminescence of the organic residue peaked around 560 nm at room temperature. Upon annealing the sample at successively higher temperatures, from 100° C to 350° C, we did not find a measureable shift in the peak wavelength, but we did observe a marked decrease in the relative PL efficiency of the sample. The relative intensity of the PL peak after annealing at 350° C for 30 min was down by a factor of 1500 from the peak intensity prior to annealing. This organic residue, therefore, cannot be the source of the ERE based on its PL peak wavelength, the stability of the peak as a function of temperature, and the decrease in the relative PL efficiency.

References:

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