ARE THERE DIAGNOSTIC SPECTRAL FEATURES OF IRRADIATED COMETARY ICES ?

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There is now evidence that at least some cometary nuclei are dark and red. Cometary ices prepared from combinations of CH_4 with H_2O and sometimes NH_3 were irradiated at 77 K by corona discharge. CH_4 - containing ice reddened and darkened at a dose $\sim 10^{11}$ erg cm^{-2} over a period of $\sim$1 hour. Upon evaporation of the now yellowish, irradiated ice, a slightly yellowish colored solid film remains on the walls of the container at room temperature. Transmission measurements of this organic film (called cometary tholin) were made from 0.2 μm to 50 μm wavelength. Strong UV absorption is seen from 0.45 μm to 0.2 μm. Above 0.45 μm, the spectrum remains flat to $\sim$1.3 μm in the near infrared, except for a very small feature near 1.15 μm. A medium sized feature appears centered at 1.4 μm with shoulders at both sides and a nearby weaker feature at 1.52 μm. A strong feature appears at 1.9 μm accompanied by a smaller feature at 1.78 μm. In the region 2.5 μm to 50 μm, the infrared spectrum was taken by dispersing the film in a CsI matrix. Bands are found at 2.92(M), 3.36(S), 3.40(S), 3.46(M), 3.48(M), 5.75(M), 5.99(S), 6.21(M), 6.83(M), 7.30(S), 7.81(W), 8.89(M), 9.26(M), 20.00(W), 22.22(W), and 28.57(W) micrometers, suggesting complex organics including alkane, alkene, aldehyde, and carboxylic acid functional groups. These results are also relevant to UV and cosmic ray processing of interstellar grains, and to icy bodies in the outer solar system.

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