

Polycyclic Aromatic Hydrocarbons in Cometary Ice Tholins and the Optical Constants of Cometary Ice Tholins

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We have produced ice tholin I and II from charged particle irradiation at 77 K of an intimate mixture of 1:6 C₂H₆:H₂O and 100:20:4:1 H₂O:CH₃OH:CO₂:C₂H₆ respectively to simulate the processing of cometary ices. We find polycyclic aromatic hydrocarbons (PAHs) in both tholins by microprobe two-step laser mass spectrometry (μ L²MS). In ice tholin I the PAHs appear to exist in two distinct phases. The first phase, which constitutes > 99% by volume, is yellow-brown in color and contains a homogeneous distribution of low mass PAHs at \approx 0.1-10 ppm. The second phase < 1% of the sample by volume appears in the form of discrete brown-to-black particulate randomly distributed through the yellow-brown bulk matrix. These dark particulates are extremely rich in PAHs with a concentration >300,000 ppm. In ice tholin II the PAH distribution, in contrast, appears to exist as a homogeneous single phase at a concentration \approx 0.1-10 ppm with a region-to-region variation of < 30% at a 50 μ m scale. Ice tholin II has also been examined by the synchronous fluorescence technique. The results confirm the presence of 1-, 2-, and 3-ring PAHs but also indicates the presence of 4-, 5-, and 6-ring PAHs at higher concentrations. It appears the vast majority of the aromatic material within ice tholin II is present in the form of a complex polymeric matrix, perhaps similar to that of meteoritic kerogens. We present our revised optical constants for ice tholin I, and compare with optical constants of ice tholin II.