Electron Irradiation of Titan's Ice Analogues

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Benzene (C_6H_6) has been detected in Titan's methane (CH_4)- and nitrogen (N_2)-dominated atmosphere and is likely to be a key component of Titan's haze.[1] The energetic processing of aromatic molecules in the presence of volatile components could result in the synthesis of complex organic compounds; such as polycyclic aromatic hydrocarbons (PAHs) or polycyclic aromatic nitrogen heterocycles (PANHs).[2] Several laboratory studies have revealed that the energetic processing of benzene can result in the formation of complex organics and solid residue grains with distinct geometrical shapes.[3-6] In order to better understand the physical and chemical properties of Titan's haze materials, the non-volatile residues produced from the energetic processing of aromatic molecules in the presence of N_2, CH_4, and H_2O must be explored utilising spectroscopy and electron microscope imaging.

Using the *Ice Chamber for Astrophysics-Astrochemistry (ICA)* at ATOMKI, Debrecen, Hungary,[7] we exposed a number of distinct ice mixtures of C_6H_6, CH_4, N_2, and H_2O to 2 keV electron irradiation at 20 K and at 90 K. To better understand the evolution of the ice, the infrared spectra and mass spectra of the processed ices were recorded before and after irradiation as well as at various temperatures after irradiation. At room temperature, some residue remained on the substrate. Both the recorded infrared and mass spectra have evidenced the formation of new molecules during irradiation. The residue will be examined using a scanning electron microscope (SEM) and a chromatograph attached to mass spectrometer. These experimental results will be useful for better comprehending the haze or organics in Titan's clouds. The outcome and significance of these experiments will be discussed at the conference.

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