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Interaction of Low Energy (0-20 eV) Electrons with Sulfur Dioxide on Ice Surfaces

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We studied the interaction of low energy (0-20 eV) electrons with sulfur dioxide (SO_2) on a crystalline ice film surface. An ice film was prepared by H2O vapor deposition on a Pt(111) substrate at 150 K for thickness of >100 BL inside a vacuum chamber and was annealed at 165 K to produce a crystalline ice film with a flat (0001) surface. SO_2 gas was adsorbed on the crystalline ice film through a tube doser. The surface adsorbates were analyzed using the methods of Cs+ reactive ion scattering (RIS) and low energy sputtering (LES), which revealed molecular SO2 adsorption at ~95 K and the occurrence of the hydrolysis of SO_2 at >100 K.[1] We irradiated low energy electrons, produced from an electron flood gun, onto the ice film surface with adsorbed SO_2 at 95 K. While the low energy electrons transmit through an ice film, they were trapped quite efficiently by the SO_2 adsorbates on the surface. The amount of SO2−trapped electrons was estimated by measuring the film voltage with a Kelvin probe at various incident energies of the electrons. RIS and LES measurements of the surface show that the electron-trapping by SO2 produces various negative ion species, such as OH^-, SO_2^-, SO_3^-, and HSO_3^-.

(1) Bang, J.; Shoaib, M. A.; Choi, C. H.; Kang, H. Efficient Thermal Reactions of Sulfur Dioxide on Ice Surfaces at Low Temperature: A Combined Experimental and Theoretical Study. ACS Earth and Space Chem. 2017

Significance statement

SO_2 adsorbates on crystalline ice film can trap low energy (0-20 eV) electrons, and it produces various negative ion species such as OH^-, SO_2^-, SO_3^-, and HSO_3^- at 95 K.

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