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ELECTRON INDUCED PROCESSES IN DIELECTRIC INSULATION GASES

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Abstract. A strong greenhouse gas SF_6 (sulfur hexafluoride) with a GWP of 23k, is still in wide global use due to its exceptionally high dielectric strength. It is mainly used in the electrical power distribution industry in various high-voltage outdoor switchgear devices. Over recent decades, a continuously increasing efforts have been invested towards reducing the emission of greenhouse gases. Therefore, a few suitable SF_6 replacement gases have been proposed, however, not much is known about their fundamental physical and chemical properties. In that regard, it is important to study electron collision processes in these gases in order to better understand their behavior under an electric discharge.

In this talk, we will give an overview of electron induced processes focusing mainly on SF_6 replacement candidate C_4F_7N (heptafluoroisobutyronitrile). Combining both experimental and theoretical approaches we explore dissociative ionization dynamics [1], transient anion states (resonances) [2], as well as electronic excitation and fragmentation processes [3]. The experiments reveal several interesting phenomena, where a number of resonances are formed in the electron scattering, leading to vibrational excitation of the molecule. Computational treatment of the ionization process indicate that a broad range of cation states is initially formed, corresponding to holes in various molecular orbitals. Moreover, modeling of the fragmentation processes using the techniques of non-adiabatic dynamics reveals the main fragments which are expected to form in an electric discharge.

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