

**Title:** Recombination study of ions with electrons at temperatures below 300 K

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**Abstract:** Presented is the study of recombination of ions with electrons performed at low temperatures using the Flowing afterglow with Langmuir probe experimental technique. Studied was the dissociative recombination of  $\text{H}_3^+$  and  $\text{D}_3^+$  ions at temperatures 77 – 300 K. Apart from a two-body also a three-body recombination channel assisted by neutral He atoms was identified and studied. The obtained temperature dependence of the two-body recombination rate coefficient is in a good agreement with findings of other experimental and theoretical works. The dissociative recombination of  $\text{HCO}^+$  and  $\text{DCO}^+$  ions with electrons was studied in the temperature range 150 – 300 K. The observed temperature dependence of measured recombination rate coefficient for  $\text{HCO}^+$  and  $\text{DCO}^+$  ions ( $\sim T^{-1.3}$  and  $\sim T^{-1.1}$ , respectively) is in agreement with the majority of previous experimental works and evokes that indirect mechanism governs the recombination process. The electron-assisted collisional-radiative recombination of  $\text{Ar}^+$  ions was for the first time studied at temperatures 50 – 300 K. The measured temperature dependence of the recombination rate coefficient  $\sim T^{-4.5}$  corresponds with the value given by the theoretical works. For the measurements at cryogenic temperatures below 77 K a novel FALP-type apparatus was developed and constructed – Cryo-FALP II.

**Keywords:** dissociative recombination, collisional-radiative recombination, FALP,  $\text{H}_3^+$ ,  $\text{HCO}^+$