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Recent Studies of Cross Sections, Rates and Branching Ratios for the Recombination of Ions in Industrial Plasmas

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Branching ratios for the dissociative recombination of hydrocarbon ions with the general formula $C_2H_3^+$, $C_3H_m^+$ (m=1- 8) and $C_4H_m^+$ (m=1-9) have been measured using the ASTRID storage ring in Aarhus [1-3]. The detector used did not have sufficient energy resolution to distinguish hydrogen atoms either free or attached to carbon atoms so the relative distributions of carbon atoms among the dissociation products were measured. For most of the ions that were in linear isomeric form, the fragmentation patterns were predictable from the structure of the parent ion. For cyclic isomers however, this was not so clear and indications are that ring opening occurs prior to dissociation. Results obtained for $C_2H_3^+$ and $C_3H_7^+$ are in excellent agreement with studies performed by the CRYRING group in Stockholm [4,5]. Rare gas hydride ions are important in several industrial applications and recent cross section measurements have shown that while NeH^+ [6] does recombine at low energies, ArH^+ [7] does not. Both these ions display recombination resonances and dissociative excitation onsets at higher electron energies. The fluorocarbon ions, CF^+, CF_2^+ and CF_3^+ that are found in semiconductor etching plasmas have been examined in a collaborative effort with the CRYRING group and results for cross sections and branching ratios will be presented [8-10]. Work supported by the European Union, AFOSR, EOARD, the Danish and Swedish Research Councils and the French Centre National pour la Recherche Scientifique (CNRS)

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