REVERSE POLARITY ELECTRON-BEAM-PLASMA ION SOURCE

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One of the major problems associated with generation of useful beams of $^{17,18}F$ for astrophysics research is that fluorine is released from refractory metal-oxide target materials as the metal-mono-fluoride, MF. While these molecules are gases at all temperature above -253 °C, and consequently have good transport properties through the target ion source system, the metal-fluoride molecule must be dissociated and the atomic F efficiently negatively ionized for injection into the 25 MV tandem accelerator. To date, charge exchange has been the method used for both dissociation and F^- formation. This method is inefficient since the molecule must first be formed as MF^+ and then directed through a charge exchange cell for dissociation followed by sequential charge exchange to form F^-. Since the process involves three collisions, the quality of the F^- beam is very poor. It is well known that negative ions can be formed by attachment of an electron to one of the atoms of a molecule during dissociation with energetic electrons (dissociative attachment). During this fiscal year, the EBPIS was operated as a negative-ion-source by introducing known flow rates of SF_6 into the source in combination with Cs vapor.[1] The fluorine combines with Cs to form CsF, or other transport agents such as Al to form AlF. Preliminary results indicate that these MF molecules can be dissociated to form F^- with an efficiency of ~ 0.1% to 0.3%. A brief account of this work in abstract form is included in another contribution to this report.

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[1] G. D. Alton, R. F. Welton, S. N. Murray, Rev. Sci. Instrum.