RF POSITIVE ION SOURCE

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RF power has been utilized for many years as a means for generating plasmas for positive- and, more recently, negative-ion source applications. These sources have considerable appeal due their improved lifetimes over *dc* sources that utilize hot cathodes to sustain the discharge. The use of RF power for plasma ignition also reduces the complexity of operation and lowers overall source maintenance. These sources are particularly attractive for generation of positive-ion beams from gaseous feed materials. A plasma-sputter-negative-ion source based on the use of RF power is described in another contribution to the present Annual Progress Report; this source can also be operated in positive mode by simply reversing the polarity of the source, in which case, positive particles are directly extracted from the plasma boundary. The source, illustrated schematically in Fig.1, utilizes the same matching-network and high-Q, self-igniting, inductively-coupled, antennae system, operating at 80 MHz, developed for the plasma-sputter negative-ion source. For positive-ion source applications, high plasma densities are desirable in which case small radii coils, with large number of turns and as long as practical, are preferred. To date, the source has been utilized to generate *dc* positive ion beams of Ar^+, Kr^+ and Xe^+ with the low plasma-density, 37-mm diameter, 4-turn antenna, described in another contribution to this report, that was designed specifically for negative-ion beam generation. Intensity versus RF power for these species are shown in Fig. 2. The intensities can be increased by ~5 by utilizing the smaller, 19-mm diameter, 5-turn antenna, also described in another contribution to this report, that was specifically optimized for positive-ion beam generation. The normalized emittance ε_n of the source at the 80% contour is: ε_n = 4.0 mm.mrad.$(MeV)^{1/2}$.

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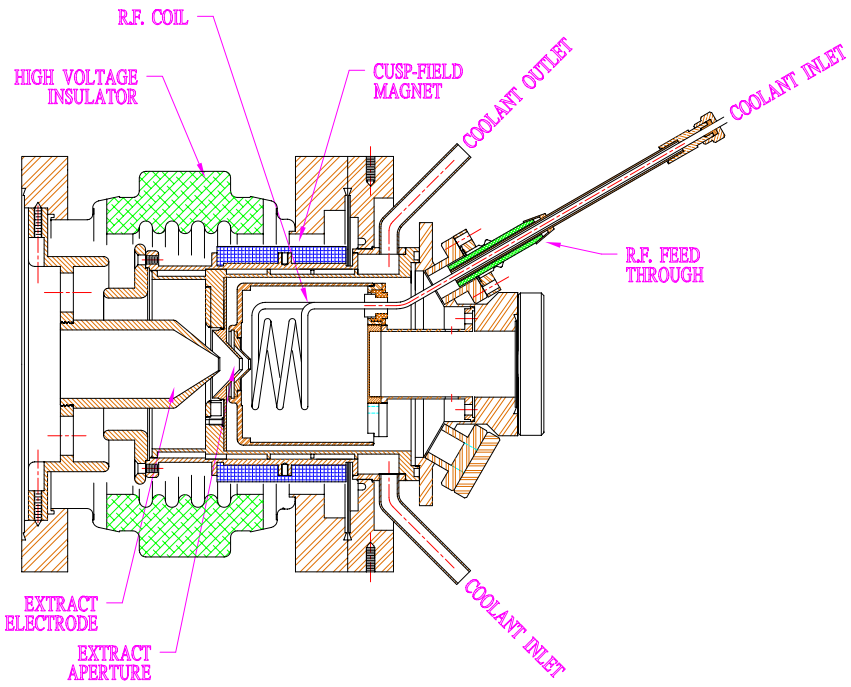

Fig. 1. Schematic drawing of the RF positive ion source.

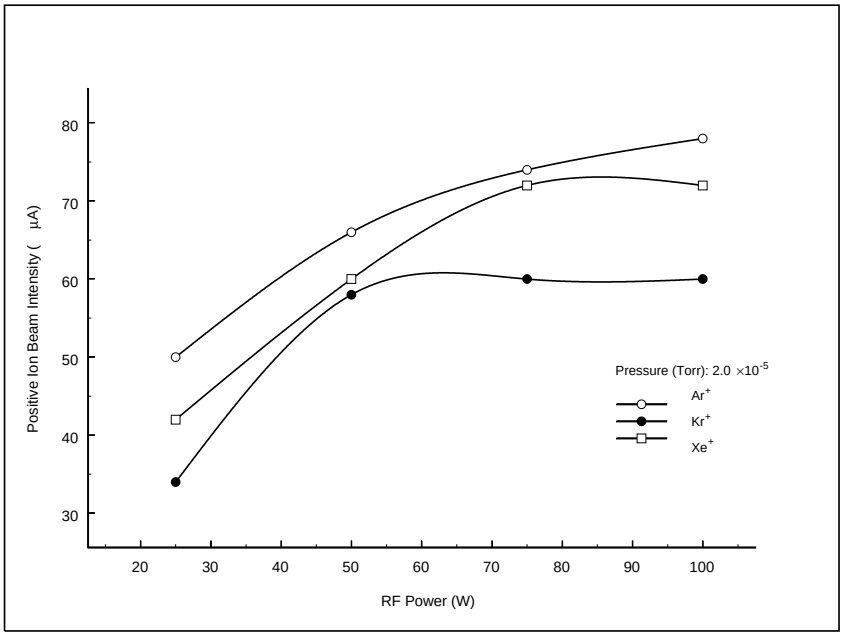

Fig. 2. Ar+, Kr+ and Xe+ ion beam intensity versus RF power for the positive RF ion source. External pressure: 2.0 x 10^{-5} Torr.