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Metal Vacuum Arc Variants for High Charge State Ion Generation

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Certain adaptations of metal vapor vacuum arcs can be a promising approach as high charge state ion sources for various applications including relativistic heavy ion colliders, heavy ion inertial confinement fusion and with modifications to boron phosphorous as well as for As, and Sb ions for ion implantation for semiconductor manufacturing as well. Two approaches have shown good promise: E-MEVVA and LIZ-MEVVA, which are the acronyms for electron beam metal vapor vacuum arc and low-inductance Z-discharge metal vapor vacuum arc respectively. In the first a metal vapor vacuum arc is generated through which an intense electron beam is injected to successively ionize the vacuum arc generated ions to high charge states. Charge state enhancement in the latter is achieved by ignition of a high current magnetized axial in low charge state metal vapor vacuum arc generated ions. Large currents 10's mA of Pb^{7+} , Bi^{8+} , Sn^{+6} , Cd^{+5} ; In^{+5} , P^{+4} , and Sb^{+6} were generated by E-MEVVA with electron beam current of 80 A; very large currents 100's mA of Au^{+19} were generated by LIZ-MEVVA with currents of 88 kA. Devices, physical processes for generating the high charge state ions, well as novel embodiments for generating larger ions beam with even higher charge state will be described.

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