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Self-neutralized ion beam

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A vacuum arc ion source provides high current beams of metal ions that have been used both for accelerator injection and for ion implantation, and in both of these applications the degree of space charge neutralization of the beam is important. In accelerator injection application, the beam from the ion source may be accelerated further (post-acceleration), redirected by a bending magnet(s), or focused with magnetic or electrostatic lenses, and knowledge of the beam space charge is needed

for optimal design of the optical elements. In ion implantation application, any build-up of positive charge in the insulating targets must be compensated by a simultaneous flux of cold electrons so as to provide overall charge neutrality of the target. We show that in line-of-sight ion implantation using a vacuum arc ion source, the high current ion beam carries along its own background sea of cold electrons, and this copious source of electrons provides a “self-neutralizing” feature to the beam. Here we describe experiments carried out in order to demonstrate this effect, and we provide an analysis showing that the beam is space-charge-neutralized to a very high degree

Topics

Vacuum arcs, **Focused ion beam**, **Ion implantation**, **Ion source**, **Leptons**, **Ions and properties**, **Transition metals**, **Charge compensation**, **Depth**

profiling techniques, Charge exchange reactions

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