

On the optimization of high brightness ion beam extraction from plasma using ray-tracing code

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The application of focused ion beams (FIB) to the nano-fabrication and nano-measurement with minimum dimension of 10 ~ 100 nm has grown rapidly during the last few years. In order to achieve high resolution FIB, high brightness ion source has to be developed because spot size of focused beam strongly depends on the source brightness as well as lens aberrations. Conventional FIB's using gallium liquid metal ion sources are not adequate for the nano-structure measurements because gallium ions can cause contaminations or damages to the structure of objects. Moreover, doped layer by Ga^+ ion beam bombardment has undesirable effects (e.g. erosions) on Al metal wiring in semiconductor circuit. To use inert ion species and light ion species in FIB, we have designed a novel ion source with high density plasma. Ray-tracing simulation code (PBGUNS) has been used for evaluating the design. Taking account of the effect of minimized aperture of plasma electrode and finite ion temperature, various features of controlling the brightness will be discussed in this article.