

TuePS22

Generation of Boron Ion Beam Based on Discharges with Composite LaB₆ Cathode

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Boron ion beam is widely used for implantation in semiconductors. Another attractive application for such ions is metal surface modification to improve operating parameters and to increase lifetime of machine parts and tools. For this purpose requirement for high purity boron ion beams is not so demanding like for semiconductor technology. That is why a composite cathode of lanthanum hexaboride (LaB₆) was chosen to produce boron ions. Two discharge units were used in experiments: vacuum arc and planar magnetron in self-sputtering mode of operation. The discharges operate in pulsed mode with pulse length of 100 μs, pulse repetition rate up to 10 pps and discharge current of about 100 A. For arc discharge, the boron plasma is generated in cathode spots, where as for magnetron discharge the main process is sputtering of the cathode material. The paper presents results of comparative test experiments for both discharges aimed to find optimal discharge parameters that provide maximum yield of boron ions. As a result of optimizations, for both discharges the extracted ion beam current reaches hundreds of milliamps and the fraction of boron ions in the total extracted ion beam was as high as 80%.

Work is supported by the Russian Science Foundation under grant # 14-19-00083.