

HE2+ SOURCE BASED ON PENNING DISCHARGE WITH ADDITIONAL 75 GHZ ECR HEATING

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Abstract

It is well known that one can reach high average charge of ions in the ECR plasma by increasing plasma density and decreasing neutral gas pressure. ECR discharge could be realized at very low gas pressure, but discharge breakdown takes longer time when gas pressure is low. So, it is impossible to realize ECR discharge with limited microwave heating pulse duration at gas pressure lower certain threshold value. This problem could be solved with help of trigger plasma, which should be ignited at low gas pressure in the trap with high magnetic field. This fore plasma could help to decrease ECR plasma breakdown time significantly and make it possible to realize ECR plasma at very low pressure in pulse operation regime. We suggest penning type discharge as a

trigger discharge for fast breakdown of pulsed ECR plasma. Penning type discharge glows at as low pressure as needed. Discharge was realized in the simple mirror magnetic trap at pressure about $1E-5$ mbar. Helium was used as an operating gas. Significant plasma density (about $1e11$ cm⁻³) was obtained at the moment just before microwave heating pulse started. Gyrotron radiation with frequency of 75 GHz, microwave power up to 200 kW and pulse duration up to 1 ms, was used for plasma heating. In the present work the fully striped helium ions were demonstrated, average charge of ions in the plasma was equal 2. Temporal evolution of charge state distribution was investigated. Charge state distribution over helium pressure was also studied.

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