

Development of Li ion beam with NEOMAFIOS

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NEOMAFIOS [1] is the 10 GHz ECR ion source for light and medium mass ions. Li ion, one of those ions, is currently produced by a LiF rod sputtering method with He support gas and more intense and stable beam is required for some experiments. For that purpose, a Li oven system has been developed and we obtained about one order intense Li ions in comparison with LiF sputtering method [2]. Li atoms are evaporated from pure metal and introduced into the ECR plasma chamber,

The developments has been continued to realize a long term stability of the system. A hot liner (Figure 1) has been installed to avoid Li vapor condensation on the ECR chamber wall which is cooled by water. The instability of plasma sometimes happens due to this condensed Li. The liner is made of thin Ta plate and has cylindrical shape which radius is about 2-3 mm less than the plasma chamber radius. The Ta liner keeps high temperature for avoiding Li condensation because of the plasma heating and the thermal insulation from the chamber wall.

The material of Oven Head has been changed to SUS from Cu as well. The prototype of Li oven head was made of Cu because of its high thermal conduction for effective heating by cartridge heater placed in the back of the oven head. However such high thermal conduction leads positive feedback by plasma heating easily and the evaporation condition got out of control. The chemical problem between Cu and Li also occurred. Then the material of oven head has been changed to SUS (Figure 2,3).

After these modifications, very stable Li ion production has been achieved. Currently about 10-30 $e\mu A$ ${}^7\text{Li}^{2+}$ beam with about 3.5 days lifetime is produced with conditions of 400°C oven temperature, He support gas and 2 mm ϕ hole on the face of oven head. About 50-100 $e\mu A$ ${}^7\text{Li}^{2+}$ with about 2.5 days lifetime is also produced with 3 mm ϕ hole.

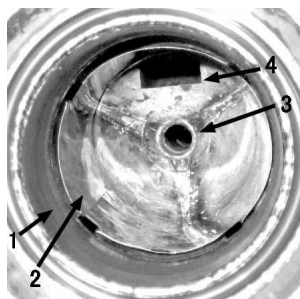


Figure 1: Ta hot liner placed inside the NEOMAFIOS chamber: 1) chamber wall 2) hot liner 3) gas port 4) RF port



Figure 2: Li oven head: The hole diameter is 2-3 mm ϕ .

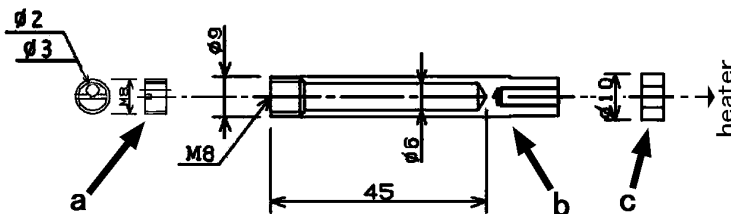


Figure 3: The details of Li oven head system in millimeter unit: a) cap of oven head: Li vapor comes out through its hole. b) main body: maximum capacity is about 1 cc for Li metal. c) insulator made of photoveel from NEOMAFIOS gas port pipe.

References

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- [2] T. Yorita *et al.*, RCNP Annual Report 2006 p57