Contribution ID: **24** Type: **Short oral**

Discoloration of RF antenna coil surface after long-term operation of J-PARC ion source

Wednesday 5 October 2022 11:40 (20 minutes)

In J-PARC (Japan Proton Accelerator Research Complex) center, continuous operation duration of the Radio Frequency (RF) negative hydrogen (H^-) ion source equipped with the internal RF antenna coil is extended step by step in these 6 –7 years for the goal to supply stable beam during the entire period of J-PARC user operation each year. From Nov. 2020 to Apr. 2021, the continuous ion source operation for 3,651 hours (5 months) was achieved with 60 mA H- beam current at the ion source exit, 0.825 % duty factor (25 Hz repetition) and 25 kW RF power injection. As the lifetime of the RF ion source is mainly limited by failure on the enamel coating of the RF antenna, detailed evaluation of the antenna surface is required to ensure feasibility of the further extension of the operation time.
In the present study, surface discoloration on the RF antenna coil observed after the 5 months operation [1] is investigated by application of digital microscope and SEM/EDS analyses. The material mapping and the line spectrum obtained by the EDS analysis show that depositions of the sputtered source chamber wall materials and the injected cesium on to the enamel coating are the most possible candidate for the discoloration. The dimension measurements of the RF antenna thickness before and after the long-term operation support the idea that the discoloration is due to the deposited materials and hence insulation of the RF antenna coil by enamel coating is maintained. The emittance measurement after the operation also shows that the RF plasma and the beam formations are not affected by the deposition on the antenna.
On the other hand, possible mechanisms leading to antenna catastrophic failure starting from material depositions on the antenna coating will be discussed in the presentation with the present status of the J-PARC RF ion source.

[1] T. Shibata, *et al.*, J. Phys. Conf. Ser. **2244** 012041 (2022).

Primary author: Dr SHIBATA, Takanori (KEK)

Co-authors: OGURI, Hidetomo (JAEA); SHINTO, Katsuhiro (JAEA); Mr NANMO, Kesao (KEK); OHKOSHI, Kiyonori (JAEA); IKEGAMI, Kiyoshi (KEK); ISHIDA, Masaki (KEK); WADA, Motoi (Doshisha University)

Presenter: Dr SHIBATA, Takanori (KEK)

Session Classification: Oral session 8

Track Classification: 18. Sources for high energy physics