Contribution ID: **44** Type: **Invited**

Construction Status of the FRIB Lithium Charge Stripper

Monday, 8 October 2018 09:40 (40 minutes)

The Facility for Rare Isotope Beams (FRIB) at Michigan State University is building a heavy ion linac to produce rare isotopes by the fragmentation method. The linac will accelerate ions up to U to energies above 200 MeV/u with beam powers up to 400 kW. At energies between 16 and 20 MeV/u the ions will be stripped to higher charge states to increase the energy gain downstream in the linac. The main challenges in the stripper design are due to the high power deposited by the ions in the stripping media (~ 30 MW/cm3) and radiation damage if solids are used. For that reason self-recovering stripper media must be used. The FRIB baseline choice is a high-velocity (~ 50 m/s) thin film (~ 10 μm) of liquid lithium [1].

On the basis of the collaboration work with Argonne National Laboratory, the construction of the lithium stripper module was initiated at FRIB. Main and unique features of the system that have been added since the development at ANL are a spiral DC electromagnetic pump enabling continuous circulation of liquid lithium, and a double containment system to prevent/mitigate lithium-related hazards. The pump was originally designed at ANL, but modified by FRIB for the lithium application. It is equipped with Sm-Co permanent magnets and supplied with a DC current of several hundred amps. The Lorenz force created by the interaction between electric and magnetic fields along the long spiral tube generates a high discharge pressure. Pump performance test results confirmed that our pump can create a desired flow of ~ 10 cc/s at ~ 1.4 MPa. Regarding the hazard controls associated with the use of liquid lithium, lithium-air reaction and resulting lithium fire were our concerns. To prevent and mitigate this hazard, we employed a double containment system: the primary lithium loop is completely enclosed by the secondary containment vessel filled with inert argon gas. Because of this unique configuration, any lithium leaks from the primary loop will not be considered fire hazards and such leaks will be detected by various leak detection mechanisms. This assures no lithium fire takes place in case that lithium leaks out of the primary loop.

So far the module has been assembled, and the primary lithium loop has been loaded and charged with all the necessary amount of lithium (~ 5 liters). After all of those works, the lithium was melted with heaters and successfully circulated with the electromagnetic pump.

[1] Thin-film liquid-lithium stripper for the RIA driver linac. DOE RIA R&D proposal (2003).

*This work is supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661

Primary author: Dr KANEMURA, Takuji (Facility for Rare Isotope Beams, Michigan State University)

Co-authors: Dr MARTI, Felix (Facility for Rare Isotope Beams); LAVERE, Michael (Facility for Rare Isotope Beams); MADENDORP, Randall (Facility for rare Istope Beams); MOMOZAKI, Yoichi (Argonne National Laboratory)

Presenter: Dr KANEMURA, Takuji (Facility for Rare Isotope Beams, Michigan State University)

Session Classification: Session 1- Beam Charge Strippers (foil, liquid, gas, plasma)

Track Classification: 2 - Beam charge strippers (foil, liquid, gas, plasma)