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First experimental evaluation of the Forced Electron Beam Induced Arc Discharge (FEBIAD) ion source for the RAON ISOL system

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The Isotope Separation On-Line (ISOL) facility at the Rare Isotope Accelerator complex for ON-line experiments (RAON) produces rare isotope (RI) beams using various ion sources to support a wide range of research applications. Following the successful commissioning of RI beams using a Surface Ion Source and a Resonant Ionization Laser Ion Source (RILIS), a new Forced Electron Beam Induced Arc Discharge (FEBIAD) ion source was developed to extend the range of RI beams available at the facility. To evaluate the FEBIAD ion source, an ISOL Offline Test Facility (OLTF) was established. The OLTF consists of a target/ion source system, ion beam optics, beam diagnostics, a dipole magnet, a vacuum system, and a control system.

In the initial experiments, key operational parameters such as beam stability and thermal behavior under high-temperature conditions were measured. Additional tests, including emittance measurements, beam current analysis, and reliability assessments of the ion source, were also performed. In particular, the successful extraction of an argon (Ar) isotope beam was achieved, clearly demonstrating the feasibility of RI beam production using the FEBIAD ion source. Long-term operation tests further verified the stable performance of the conventional FEBIAD source under high-temperature conditions. This study presents and discusses the operational characteristics and emittance measurement results of the FEBIAD ion source at the RAON ISOL facility.

Future studies will involve systematic investigations using various noble gases to assess the ionization efficiency, thermal stability, and beam quality of the FEBIAD ion source. These efforts aim to validate its performance across a broader mass spectrum. Based on the findings of this study, stable and rare isotope beam experiments under online conditions are being planned to ensure reliable beam production at the RAON ISOL facility.

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