INDUCTIVELY HEATED HOT CAVITY CATCHER LASER ION SOURCE

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The IGISOL (Ion Guide Isotope Separator On-Line) facility [1] at the University of Jyväskylä is a versatile system for producing exotic ion beams. In normal operation, the primary beam induces nuclear reactions in a thin target with the resulting reaction products being stopped in a gas volume [2]. These are subsequently thermalized with a significant fraction remaining in a +1 charge state. The gas flow guides the ions out of the ion guide via an exit hole into a radiofrequency sextupole ion guide (SPIG) [3]. The ions are subsequently accelerated to 30 keV energy and mass separated.

While the ion guide method has been proven to be a formidable and universal tool for producing radioactive isotopes it suffers, in some cases, from low efficiency. This poses a challenge for the production of exotic isotopes in the current heavy ion fusion evaporation reactions at IGISOL [4, 5]. A development program has been initiated [6, 7] to selectively and efficiently produce a low-energy ion beam for a few selected cases using a hot cavity catcher laser ion source.

An inductively heated hot cavity catcher has been constructed at IGISOL for the production of exotic Ag isotopes. A proof of principle experiment has been performed by implanting a $^{107}\text{Ag}^{21+}$ beam from the K-130 cyclotron into the catcher. The initial beam energy of 487 MeV was varied using a tilting 12.5 $\mu$m nickel degrader in order to vary the ion implantation depth. First, the implanted silver atoms diffused out of the graphite catcher and subsequently effused out of the catcher cavity whereby they were resonantly ionized with lasers. The extracted and mass separated ions were identified by scanning the first step laser over the resonance. The total evacuation time for different implantation depths and cavity temperatures was measured by pulsing the primary beam and measuring the ion signal rise time on a set of multi-channel plates located in the focal plane of the mass separator. Furthermore, the beam quality was studied by both experimental and numerical methods.