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High efficiency ISOL system to produce neutron deficient short-lived alkali RIBs on GANIL/SPIRAL 1 facility

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ABSTRACT

SPIRAL1 (Système de Production d'Ions Radioactifs Accélérés en Ligne) facility at GANIL (Grand Accélérateur National d'Ions Lourds) is developing new techniques to access nuclei in the neutron deficient isotope region far from the stability-valley, with Z ranging from 30 to 60. The availability of different primary beams, ranging from carbon to uranium with energies up to 100 MeV/A, gives an opportunity to produce a large variety of radioactive ion beams. The production of neutron deficient short-lived alkalis by fusion-evaporation reactions is the focus of this work. A design of simple and compact target ion source system is developed to produce isotopes of ^{74}Rb ($\tau_{1/2} = 65$ ms) and ^{114}Cs ($\tau_{1/2} = 570$ ms). The radioactive recoils are produced by interaction of heavy-ion beams, respectively $^{20}\text{Ne}@1013$ pps and $^{58}\text{Ni}@1012$ pps, with a thin ^{58}Ni target and are subsequently stopped in a catcher. The implanted recoils diffuse and effuse into the target ion source cavity, where they are ionized by surface ionization process. By applying an electric field in the cavity, the ions are guided towards the exit hole.

This system should offer an enhanced atom-to-ion transformation efficiency (e.g. higher than 75% and 95% for the ^{74}Rb and ^{114}Cs nuclei respectively). The intensity of RIBs is estimated to attain about 104 pps. The different aspects of the design and of the technical principles will be described: effusion, thermal, electrical and mechanical studies. The first off-line measurements of the thermal properties and response time will finally be presented.

Key words: neutron-deficient isotopes, fusion-evaporation reaction, ISOL technique, surface ionization, Target Ion Source System, SPIRAL1.

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Category: Isotope production, Target and ion source techniques

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