Developments for intensive short lived carbon and nitrogen beams.

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Radioactive Ion Beams (RIB) are of high interests for a great variety of applications. ISOL (Isotope Separation On Line) facilities provide RIB with high beam intensities and good beam quality. Some elements, though, are more difficult for production in this way since they are reactive and easily form chemical bonds with surrounding materials, examples are: C, N, and O. Optimization of these beams demands a good knowledge of their chemical interaction with surfaces in the target unit; consisting of target material, target container, transfer line and ion source. An atom that is produced within the target will first diffuse out from the target material. During the effusion towards the transfer line and into the ion source it will have many contacts with the surfaces around. During each contact the atom has a chance to either react with the material or at least stick for some time on the surface before continuing. This causes unacceptable delays in the transport and, hence, losses of the shorter lived isotopes[2]. Systematic chemical investigations have been performed of potential construction materials for the target and ion source unit, with regards to CO_x and NO_x.

Results about adsorption and desorption on different target and construction materials have been achieved with off-line and on-line experiments performed using a gas thermo-chromatography set-up. The experiments were perfomed with radiotracers ^{11}C and ^{13}N from the PROTRAC [1] facility at Paul Scherrer Institute in Villigen, Switzerland. On-line tests at ISOLDE/CERN have been done with a typical set-up with a MgO powder target and a FEBIAD ion source. Beams of $^{9-16}$C have been separated, but their overall intesity is relatively low due to huge losses of CO reacting with the hot tantalum cathode and/or graphite grid of the FEBIAD. A 1^+ ECRIS like, e.g. Minimono[3], is intrinsically better for such reactive elements as it has no hot surfaces of gettering materials. An ECRIS is available at the SIRa separator (GANIL) and the release out of different oxide samples and the overall release and ionization efficiency has been measured on-line. Pure beams of $^{10-16}$C have been produced.

[1] M. Ammann et al., Radiochimica Acta 89, 831-838, (2001).
[2] H. Frånberg et al., Rev. Sci. Instrum. 77, 03A708, (2006).
[3] F. Wenander et al., Rev. Sci. Instrum. 75, 1627-1629, (2004).

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