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Implantation Chamber for Molecular Beam Development and Diffusion Studies

The ISOL (Isotope Separation On-Line) method has been widely used for the production of radioactive ion beams for nuclear physics research. The development of isotope extraction via molecular sidebands has gained significant interest in recent years [1,2,3] because of their potential to provide access to less volatile elements that are otherwise not possible to extract out of the target. In this context, we present the commissioning of an implantation chamber designed for molecular beam development and diffusion studies. The set up consists of a heatable sample holder located in a vacuum chamber and connected to a residual gas analyser (RGA). Ion beams, provided for example by an off-line separator, are implanted into the sample, after which an oven heats up the sample to release implanted species which are subsequently studied in the RGA. The system was commissioned at the off-line separator at ISOLDE using various molecular species with the FEBIAD ion source [4]. The same principle may be employed to study diffusion characteristics by implanting isotopes into materials of interest and study the release profile in the RGA upon sample heating. The implantation chamber is currently coupled to the Offline 1 separator at ISOLDE [5] where it is being characterized; it can also be completely isolated from the separator.

[1] J. Ballof "Radioactive molecular beams at CERN-ISOLDE." CERN PhD Thesis (2021)

[2] G. Arrowsmith-Kron et al. arXiv preprint, arXiv:2302.02165 (2023)

[3] M. Kronberger et al. Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms 317 (2013): 438-441

[4] L. Penescu et al. Review of Scientific Instruments 81.2 (2010): 02A906

[5] J. Lettry, Off-Line Isotope Separator, 1994. URL <https://cds.cern.ch/record/2691985>

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Yes

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