OPERATION OF THE UNISOR SEPARATOR FACILITY

D. W. Stracener, H. K. Carter,[1] J. Kormicki,[1,2] A. H. Poland,[3] C. A. Reed,[1]
R. F. Welton, C. L. Williams[1]

In support of the RIB development program, the UNISOR separator is used in the testing and development of ion sources and target materials. Low-intensity beams (< 25 nA) of protons or deuterons from the tandem accelerator are used to produce the radioactive atoms which are then extracted from the target, ionized, accelerated, and deposited on a moving tape system to be transported to a detector. This allows us to measure the release efficiency of a target/ion source system for a given radioactive-ion while minimizing the radiological hazards.

Over the last two years the UNISOR facility has been used in twenty-eight on-line experiments in which we have studied eleven different target materials with two types of ion sources; an electron-beam-plasma source[4] for positive-ions and a Cs sputter source[5] for negative-ions. In these on-line experiments we have extracted beams of radioactive As, Ga, and Cu ions from molten metal targets, fluorine ions from thin-fiber targets, and fission fragments from a uranium carbide target. The on-line experiments fall into one of the following categories; activation of target materials followed by off-line release measurements, testing of target materials in the ion source to determine optimum operating conditions and durability, and testing of modifications to the ion source. In addition to on-line experiments, many 'off-line' measurements were made to determine the effects of source modifications and the viability of target materials with respect to elevated temperatures for long periods. The details of these tests are presented in other articles in this report.

In cases where the radioactive half-life of the radioactive species is short, the rate of release from the target is important. Since release from the target matrix is temperature dependent, the target should be as hot as possible. On the other hand, the durability and longevity of the targets typically decrease as the operating temperature increases. In most cases, it is expected that the intense beams (up to 20 μA) from ORIC will heat the target to temperatures in excess of 2300 ^{o}C. In order to heat the target to operating temperatures, an external target heater is used at UNISOR. Recently, we have designed, tested and implemented a new target heater that allows us to raise the temperature of the target to 2300 ^{o}C. This new heater, consisting of a 0.005" rhenium filament supported by 0.080" thick tungsten leads, replaces a similar version, using a 0.010" tantalum filament, which could only raise the target temperature to ~1800 ^{o}C.

A major modification of the UNISOR separator during this reporting period is the conversion to 'negative-ion' mode. This is the first time a negative-ion beam has been extracted and accelerated at UNISOR, but conversion of the separator between 'positive-ion' and 'negative-ion' modes is now routine. The high-voltage power supplies (60 kV, 30 kV and 1.2 kV) were replaced to provide the capability of switching the polarity of the output. Also the output polarities of the power supplies for the einzel lenses, the electrostatic deflection plates, and the dipole magnet are switched, depending on the charge of the ion beam.

The control system for the UNISOR separator and the target/ion source[6] has also changed during this reporting period. We use a PC-based system that communicates with the high voltage platform via a fiber optic link. The control software is written in Visual Basic and replaces the LabView software that was used previously. The interface between the computer and the power supplies consists of CAMAC modules (ADC's and DAC's). These modules have replaced the GPIB control boards that were somewhat slower and more susceptible to voltage spikes originating from small discharges on the high-voltage platform. The new system is more stable and easier to modify and/or repair.

---

[1] Oak Ridge Institute for Science and Education, Oak Ridge, TN.
[2] Vanderbilt University, Nashville, TN.
[3] Present Address: Jacobs Engineering, Oak Ridge, TN.
[4] H. K. Carter, J. Kormicki, D. W. Stracener, J. B. Breitenbach, J. C. Blackmon, M. S. Smith and D. W. Bardayan, *Nucl. Instr. and Meth. B* **126**, 166 (1997).
[5] G. D. Alton, R. F. Welton, B. Cui, S. N. Murray, and G. D. Mills, *Nucl. Instr. and Meth. B* **142**, 578 (1998).
[6] H. K. Carter, P. F. Mantica, J. Kormicki, C. A. Reed, A. H. Poland, W. L. Croft, and E. F. Zganjar, *Physics Division Progress Report for Period Ending September 30, 1994,* ORNL-6842, page 1-39 (1994).