Production of radioisotopes for application studies at RIKEN

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Due to its high sensitivity, the radioactive tracer technique has been successfully applied for investigations of the behavior of elements in the fields of chemistry, biology, medicine, engineering, and environmental sciences. We have been developing production technologies of radiotracers for application studies at RIKEN RI Beam Factory (RIBF) [1]. With 14-MeV proton, 24-MeV deuteron, and 50-MeV alpha beams from AVF cyclotron (AVF), we presently produce about 50 radiotracers from ^{7}Be to ^{206}Bi. Among them, ^{65}Zn, ^{109}Cd, and ^{88}Y are delivered to Japan Radioisotope Association for fee-based distribution to the general public in Japan. On the other hand, radionuclides of a large number of elements are simultaneously produced from metallic targets such as ^{nat}Ti, ^{nat}Ag, and ^{197}Au irradiated with a 135-MeV nucl.$^{-1}$ ^{14}N beam from RIKEN Ring Cyclotron [2]. These multitracers are also supplied to universities and institutes for collaborative researches.

Chemical characterization of newly-discovered superheavy elements (SHEs, atomic number $Z \geq 104$) is an extremely interesting and challenging subject in modern nuclear and radiochemistry. We have been developing a gas-jet transport system at the focal plane of the gas-filled recoil ion separator GARIS at RIKEN Linear ACcelerator (RILAC) to start up SHE chemistry at RIBF [3–5]. This system is a promising approach for exploring new frontiers in SHE chemistry: (i) the background radioactivities of unwanted reaction products are strongly suppressed, (ii) the intense beam is absent in the gas-jet chamber and hence high gas-jet efficiency is achieved, and (iii) the beam-free condition also allows for investigations of new chemical systems. Recently, the isotopes of element 104 (^{261}Rf), 105 (^{262}Db), and 106 (^{265}Sg) were successfully extracted to a chemistry laboratory, and their decay properties were investigated in detail with the rotating wheel apparatus for α/SF spectrometry (SF: Spontaneous Fission) [6–9]. Rapid single-atom chemistry apparatuses are under development in collaboration with nuclear chemists around the world, and soon chemical properties of new elements will be investigated.

References

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