

Fee-based activities performed by Nuclear Chemistry Group

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This article summarizes the fee-based activities performed by the Nuclear Chemistry Group in 2023, which include the distribution of radioisotopes (RIs) and utilization of heavy-ion beams in the industry.

Since 2007, RIKEN in collaboration with the Japan Radioisotope Association¹⁾ (JRIA) has distributed RIs to users in Japan for a fee. The nuclides include ^{65}Zn ($T_{1/2} = 244$ d), ^{109}Cd ($T_{1/2} = 463$ d), ^{88}Y ($T_{1/2} = 107$ d), ^{85}Sr ($T_{1/2} = 65$ d), and ^{67}Cu ($T_{1/2} = 61.8$ h) produced in the RIKEN AVF cyclotron by the Nuclear Chemistry Group. Recently, we developed a production technology for ^{139}Ce ($T_{1/2} = 138$ d) in the $^{nat}\text{La}(d, xn)^{139}\text{Ce}$ reaction for its distribution in 2024.²⁾

According to a material transfer agreement (MTA) between the JRIA and RIKEN, the JRIA mediates the transaction of RIs and distributes them to users. ^{65}Zn and ^{109}Cd are delivered approximately two weeks after an order is accepted. ^{85}Sr , ^{88}Y , and ^{67}Cu , which have short half-lives, are not stocked like ^{65}Zn and ^{109}Cd ; instead, they are produced in a scheduled beamtime after an order is accepted. Therefore, they are delivered after two or more months. Details regarding RIKEN RIs can be found on the online ordering system, J-RAM,³⁾ of the JRIA. In 2023, we delivered one and three shipments of ^{88}Y and ^{85}Sr with total radioactivity of 0.1 and 13 MBq, respectively, whereas ^{65}Zn , ^{109}Cd , and ^{67}Cu had no orders. The final recipients of the RIs included two universities, one research institute, and one private company. Figure 1 shows the yearly trends of the number of orders and amount of distributed RIs. In comparison with 2022, in 2023, the amount of distributed ^{85}Sr increased to the second highest (13 MBq) since the beginning of its distribution, whereas the number of orders decreased. Both number of orders and amount of ^{88}Y increased.

In addition, we also provide ^{211}At ($T_{1/2} = 7.2$ h) through MTAs drawn between Osaka University and RIKEN and between University of Tokyo, Saitama Medical University, and RIKEN. ^{211}At is delivered to universities directly from RIKEN owing to its short half-life. In 2023, we delivered 7.0 GBq of ^{211}At to Osaka University in 11 shipments and 100 MBq to the University of Tokyo in 2 shipments.

The Industrial Application Research Team of the Nuclear Chemistry Group promotes the utilization of heavy-ion beams in the industry. The RIKEN Nishina Center allows the use of the AVF cyclotron, RILAC2, and RIKEN Ring Cyclotron (RRC) by private companies in Japan for a fee.⁴⁾ Currently, the main users include semiconductor companies that irradiate space-use semiconductor devices with ^{40}Ar , ^{84}Kr , or ^{129}Xe ions from the RRC to simulate single-event effects due

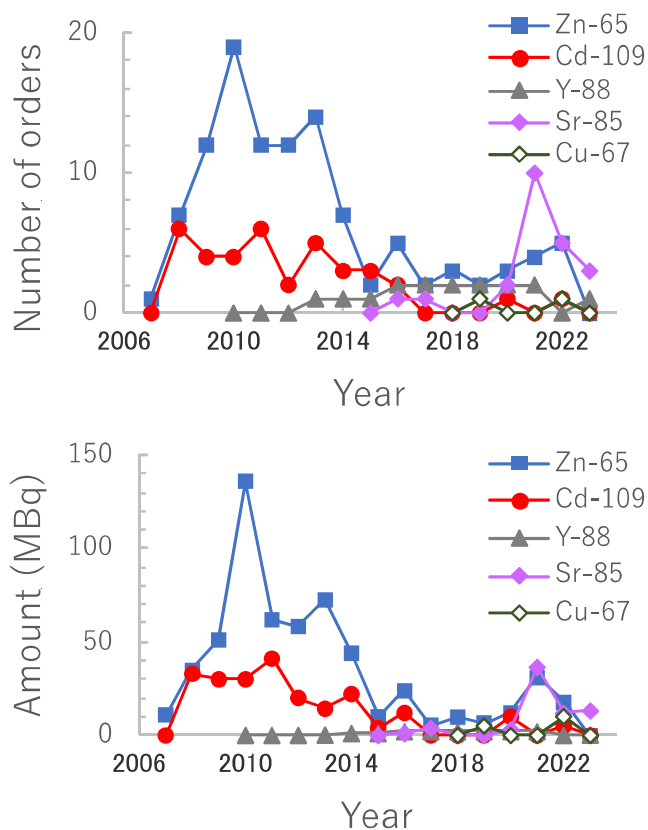


Fig. 1. Number of orders (upper) and amount (lower) of RIs distributed annually from 2007 to 2023. Distributions of ^{88}Y , ^{85}Sr , and ^{67}Cu started in 2010, 2015, and 2018, respectively.

to the heavy-ion components of cosmic radiation.

The proposals for beam utilization are reviewed by a program advisory committee dedicated to industrial use (In-PAC).

In January 2023, In-PAC held its 20th meeting where it reviewed and approved five proposals. In July, In-PAC held its 21st meeting, where it reviewed and approved seven proposals, including one new proposal.

In 2023, seven companies executed 33 fee-based beamtimes, 17 of which used a ^{84}Kr beam, 9 utilized an ^{40}Ar beam, 6 utilized a ^{129}Xe beam, and one utilized a ^{12}C beam with total beam times of 235, 124, 67, and 7 hours, respectively.

References

- 1) <http://www.jrias.or.jp/> (Japanese), <http://www.jrias.or.jp/e/> (English).
- 2) S. Egawa *et al.*, in this report.
- 3) <https://j-ram.org/> (Japanese).
- 4) <http://ribf.riken.jp/sisetu-kyoyo/HIbeam/> (Japanese).

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