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The Discoverers of the Isotopes of the Platinum Group of Elements: Update 2018

New isotopes found for Ru, Rh and Pd

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In the 2014 review (1) discovery circumstances for ^{85}Ru and ^{86}Ru were referenced only in the form of a preprint but have now been reported in the open literature (2). For the most recently discovered isotopes the discovery years for both ^{128}Rh and ^{90}Pd are the manuscript dates of the given references whilst for ^{125}Ru, ^{130}Pd and ^{131}Pd the common discovery year corresponds to the original description of these isotopes in a RIKEN Accelerator Progress Report (3). In addition the existence of the isotope ^{89}Rh has been confirmed by Čeliković *et al*. (4).

No half-lives have been reported for the new isotopes but their very detection indicates that they are all likely to be 'particle stable' – that is resistant to proton or neutron decay. The discovery circumstances of the new isotopes are given in **Table I** where the decay modes are estimated for the particular isotope mass.

Table I

Element	Mass number	Decay modes	Year of discovery	Discoverers	Reference
Ru	125	β^-	2014	Shimizu *et al*.	(5)
Rh	128	β^-	2017	Shimizu *et al*.	(5)
Pd	90	EC + β^+ ?	2016	Čeliković *et al*.	(4)
Pd	130	β^-	2014	Shimizu *et al*.	(5)
Pd	131	β^-	2014	Shimizu *et al*.	(5)

Notes on Decay Modes

EC: Orbital electron capture in which the nucleus captures an extranuclear (orbital) electron which reacts with a proton to form a neutron and a neutrino, so that the mass number of the daughter nuclide remains the same but the atomic number decreases by one

β^+: Positron decay in which a positron and a neutrino are emitted as a proton in the nucleus decays to a neutron. As with EC the mass number of the daughter nuclide remains the same but the atomic number decreases by one. However this type of decay mode cannot occur unless the decay energy exceeds 1.022 MeV (for example, twice the electron mass in energy units)

β^-: Beta decay in which an electron and an anti-electron neutrino are emitted as a neutron in the nucleus decays to a proton so that the mass number of the daughter nuclide remains the same but the atomic number increases by one

Table II Total Number of Isotopes and Mass Ranges for Each Platinum Group Element to 2018

Element	Number of known isotopes	Mass number range
Ru	41	85–125
Rh	40	89–128
Pd	42	90–131
Os	43	161–203
Ir	42	164–205
Pt	43	166–208

References

1. J. W. Arblaster, *Platinum Metals Rev.*, 2014, **58**, (1), 38
2. H. Suzuki, T. Kubo, N. Fukuda, N. Inabe, D. Kameda, H. Takeda, K. Yoshida, K. Kusaka, Y. Yanagisawa, M. Ohtake, H. Sato, Y. Shimizu, H. Baba, M. Kurokawa, K. Tanaka, O. B. Tarasov, D. Bazin, D. J. Morrissey, B. M. Sherrill, K. Ieki, D. Murai, N. Iwasa, A. Chiba, Y. Ohkoda, E. Ideguchi, S. Go, R. Yokoyama, T. Fujii, D. Nishimura, H. Nishibata, S. Momota, M. Lewitowicz, G. DeFrance, I. Celikovic and K. Steiger, *Phys. Rev. C*, 2017, **96**, (3), 034604
3. Y. Shimizu, T. Kubo, N. Fukuda, N. Inabe, D. Kameda, H. Sato, H. Suzuki, H. Takeda, K. Yoshida, H. Baba, F. Browne, P. Doornebal, G. Gey, T. Isobe, A. Jungclaus, Z. Li, G. Lorusso, S. Nishimura, G. Simpson, P.-A. Söderström, T. Sumikama, J. Taprogge, Zs. Vajta, H. Watanabe, J. Wu and Z. Y. Xu, 'Identification of 18 New Neutron-Rich Isotopes Produced in the EURICA Uranium Beam Campaign', in "RIKEN Accelerator Progress Report", Vol. 47, RIKEN Nishina Center for Accelerator-Based Science, Saitama, Japan, 2013, p.47
4. I. Čeliković, M. Lewitowicz, R. Gernhäuser, R. Krücken, S. Nishimura, H. Sakurai, D. S. Ahn, H. Baba, B. Blank, A. Blazhev, P. Boutachkov, F. Browne, G. de France, P. Doornenbal, T. Faestermann, Y. Fang, N. Fukuda, J. Giovinazzo, N. Goel, M. Górska, S. Ilieva, N. Inabe, T. Isobe, A. Jungclaus, D. Kameda, Y.-K. Kim, Y. K. Kwon, I. Kojouharov, T. Kubo, N. Kurz, G. Lorusso, D. Lubos, K. Moschner, D. Murai, I. Nishizuka, J. Park, Z. Patel, M. Rajabali, S. Rice, H. Schaffner, Y. Shimizu, L. Sinclair, P.-A. Söderström, K. Steiger, T. Sumikama, H. Suzuki, H. Takeda, Z. Wang, H. Watanabe, J. Wu and Z. Xu, *Phys. Rev. Lett.*, 2016, **116**, (16), 162501
5. Y. Shimizu, T. Kubo, N. Fukuda, N. Inabe, D. Kameda, H. Sato, H. Suzuki, H. Takeda, K. Yoshida, G. Lorusso, H. Watanabe, G. S. Simpson, A. Jungclaus, H. Baba, F. Browne, P. Doornenbal, G. Gey, T. Isobe, Z. Li, S. Nishimura, P.-A. Söderström, T. Sumikama, J. Taprogge, Z. Vajta, J. Wu, Z. Xu, A. Odahara, A. Yagi, H. Nishibata, R. Lozeva, C. Moon and H. Jung, *J. Phys. Soc. Jpn.*, 2018, **87**, (1), 014203

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John W. Arblaster is interested in the history of science and the evaluation of the thermodynamic and crystallographic properties of the elements. Now retired, he previously worked as a metallurgical chemist in a number of commercial laboratories and was involved in the analysis of a wide range of ferrous and non-ferrous alloys.

