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BRIEF COMMUNICATIONS

PALLADIUM AND RHODIUM AS POSSIBLE CATALYSTS FOR NUCLEAR REACTIONS

G. P. Khandorin[1,2]

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In [1] it was stated that an excessive energy arises during electrolysis of heavy water because of transformation of deuterium ions (p^+, n) into dineutronium (n, n) and the subsequent synthesis of two dineutronia in reactions

$$n, n + n, n \rightarrow \mathrm{He}^3 + n + E \text{ and } n, n + n, n \rightarrow \mathrm{H}^3 + p + E.$$

However, the interaction of an electron with a deuterium ion, as a rule, is accompanied by the formation of a deuterium atom, and the reaction (p^+, n) + $e \rightarrow n, n$ is improbable, because its energy barrier is about 2 MeV. The circumstances that the researchers noted the release of the excessive energy mainly during electrolysis of heavy water (D_2O) with the use of a palladium cathode and that the palladium compounds are catalysts for many chemical reactions give us grounds to consider palladium as the reaction catalyst necessary for overcoming the energy barrier of the above reaction. An analysis of families of numerous palladium and rhodium isotopes and of their properties leads to the following assumption. The families of the known palladium and rhodium isotopes are presented in Table 1 (the data were borrowed from [2], pp. 994–1044).

In this table, attention is attracted to two facts: 1) some palladium isotopes undergo radiative conversion by electron capture and form rhodium atoms, and 2) some rhodium isotopes decay generating electrons with energies exceeding 2 MeV and form palladium. In this case, the question arises: whether the mechanism of catalytic palladium stimulation of the reaction of proton neutralization in the deuterium ion can proceed by the scheme

$$\mathrm{Pd}\ (\mathrm{e.c.}) \rightarrow \mathrm{Rh} \rightarrow e + \mathrm{Pd},$$

$$p^+, n \rightarrow (n, n).$$

However, in order that such scheme became possible, it is necessary to admit the feasibility of electron capture during electrolysis in one or several stable palladium isotopes of which the cathode material consists.

Six stable palladium isotopes are known: Pd^{102}, Pd^{104}, Pd^{105}, Pd^{106}, Pd^{108}, and Pd^{110}. If we assume that under certain conditions, Pd^{110} can be converted into Ph^{110}, it becomes a source of high-energy electrons:

$$\mathrm{Ph}^{110} \rightarrow \mathrm{Pd}^{110} + e + 5.5\ \mathrm{MeV}\ (\mathrm{Ph}^{110} \text{ half-life is } 3.2\ \mathrm{s}).$$

[1]National Research Tomsk Polytechnic University, Tomsk, Russia; [2]Seversk Technological Institute at National Research Nuclear University "MEPhI," Seversk, Russia. Translated from Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika, No. 6, pp. 170–171, June, 2020. Original article submitted October 24, 2019.

TABLE 1. Radiation Characteristics of Palladium and Rhodium Isotopes

Palladium ($_{46}$Pd)				Rhodium (Rh)			
A	$T_{1/2}$	Decay type	Particle energy, MeV	A	$T_{1/2}$	Decay type	Particle energy, MeV
98	17.7 min	β^+	2.3	95	5.02 min	e.c.	–
99	21.4 min	β^+	2.2	95 m	1.96 min	e.c., i.t.	–
100	3.63 days	e.c.	–	96	9.90 min	β^+	3.3
101	8.47 h	e.c.	–	96 m	1.51 min	β^+, i.t.	–
102	Stable	–	–	97	32 min	β^+	2.1
103	16.96 days	e.c.	–	98	8.7 min	β^+	3.5; 2.8
104	Stable	–	–	98 m	3.5 min	β^+	–
105	Stable	–	–	99	16 days	e.c. β^+	– 0.74
106	Stable	–	–	99 m	4.7 h	e.c.	–
107	$6.5 \cdot 10^6$ years	β^-	0.03	100	20.8 h	e.c. β^+	– 2.62
107 m	21.3 days	i.t.	–	101	3.3 years	e.c.	–
108	Stable	–	–	101 m	4.34 days	e.c. i.t.	– –
109	13.46 h	β^-	1.028	102	2.9 years	e.c.	–
110	Stable	–	–	102 m	207 days	e.c., i.t. β^+, β^-	– 1.29; 1.25
111	23.4 min	i.t.	–	103	Stable	–	–
111m	5.5 h	β^-	0.28	103 m	56.12 min	i.t.	–
112	21.045 h			104	42.3 days	β^-	2.44
113	93 days	β^-	–	104 m	4.34 min	i.t.	–
114	2.4 min	β^-	–	105	35.36 h	β^-	0.568
115	41.3 days	β^-	–	105 m	45 days	i.t.	–
116	12.72 days	β^-	–	106	29.8 days	β^-	3.54
117	5.0 days	β^-	–	106 m	130 min	β^-	1.7
				107	21.7 min	β^-	1.20
				108	16.8 days	β^-	4.5
				109	80 days	β^-	2.6; 2.3
				110	3.2 days	β^-	5.5
				112	0.8 day	β^-	–
				113	~0.91 day	β^-	–
				114	1.68 days	β^-	–

Note. Here e.c. denotes electron capture and i.t. denotes isotope transition.

An analogous process can take place with other stable isotopes Pd, except Pd^{102} that after the electron capture (if possible) would be converted into Ph^{102} that does not decay by the β-decay mechanism. Thus, the conditions for overcoming the energy barrier of the reaction of deuterium ion transformation into dineutronium are created due to high-energy electrons arising during rhodium decay.

It would be desirable that scientists – experts in physics of atomic nuclei and radioactive transformations – consider the above-indicated feasibility for different current densities and a given voltage taking into account that palladium atoms in the cathode are in contact with the flux of electrons. Is it possible to provoke the internal electron transformation? It is not necessary to reject at once the above-indicated feasibility as once the assumption was rejected that the Earth is round and moreover, rotates round the Sun. After all, we do not know a lot yet, because at present there are five nucleus models, which implies that no one model could explain all properties of the nucleus.

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