IONIZATION ENERGIES OF MULTICHARGED IONS OF PALLADIUM GROUP ELEMENTS

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The available data [1] on the ionization potentials (energies) $I_{N_e}(Z)$ (eV) of the ions with the number of electrons $N_e \leq 36$ of the elements with atomic numbers Z = 39, 42, 46 are considered. The ions of this range are characterized by the correct order of filling of electronic shells. The ionization energies are analyzed by the quasi-classical method [2] of isolating the dependence on the atomic number using the function $e_{N_e}(\sigma)$:

$$\mathrm{e}_{N_e} = (I_{N_e}(Z)/E_h)\, Z^{-4/3}, \quad \sigma = \pi Z^{-1/3}. \tag{1}$$

Hear $E_h = 27.211\,386$ eV is Hartree energy.

It is shown that these data are well approximated by linear (for $N_e \leq 18$) and quadratic (for $19 \leq N_e \leq 36$) polynomials:

$$\lg \mathrm{e}_{N_e}(\sigma) = \sum_{i=0}^{i_{max}} a_i^{(N_e)} \sigma^i, \quad i_{max} = 1, 2. \tag{2}$$

Thus, it is possible to restore the ionization potentials of the remaining elements of the palladium group according to the formula

$$I_{N_e} = Z^{4/3} 10^{\lg e_{N_e}(\sigma)} E_h. \tag{3}$$

However, in practice, information about the ionization energies (potentials) of ions of one element, depending on the number of electrons in it, is more in demand. The piecewise monotonic dependence of the coefficients a_i on the number of electrons N_e is also revealed. Polynomial interpolation of fragments of the monotone dependence

$$a_i^{(N_e)} = \sum_{k=0}^{k_{max}} b_{ik} N_e^k, \quad \lg e_{N_e}(\sigma) = \sum_{i=0}^{i_{max}} \sum_{k=0}^{k_{max}} b_{ik} N_e^k \sigma^i. \tag{4}$$

allows an analytical description of the ionization energies of 288 ions with an error of the order of one percent based on the small tables of coefficients b_{ik}.

1. Kramida A., Ralchenko Yu., Reader J., and NIST ASD Team (2020). //NIST Atomic Spectra Database (ver. 5.8), [Online]. https://physics.nist.gov/asd [2021, November 17].
2. Shpatakovskaya, G. V. // Phys. Usp. 2019 V. 62. P. 186.