# Thermal Neutron Capture Cross Sections of the Palladium Isotopes*

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We have measured precise thermal neutron capture γ-ray cross-sections $\sigma_\gamma$ for all stable Palladium isotopes with the guided thermal neutron beam from the Budapest Reactor. The data were compared with other data from the literature and have been evaluated into the Evaluated Gamma-ray Activation File (EGAF)[1]. Total radiative neutron capture cross-sections $\sigma_\gamma$ can be deduced from the sum of transition cross sections feeding the ground state of each isotope if the decay scheme is complete. The Palladium isotope decay schemes are incomplete, although transitions de-exciting low-lying levels are known for each isotope. We have performed Monte Carlo simulations of the Palladium thermal neutron capture de-excitation schemes using the computer code DICEBOX [2]. This program generates level schemes where levels below a critical energy $E_{crit}$ are taken from experiment, and those above $E_{crit}$ are calculated by a random discretization of an a priori known level density formula $\rho(E,J^\pi)$. Level de-excitation branching intensities are taken from experiment for levels below $E_{crit}$ and the capture state, or calculated for levels above $E_{crit}$ assuming an a priori photon strength function and applying allowed selection rules and a Porter-Thomas distribution of widths. The advantage of this method is that calculational uncertainties can be investigated systematically. Calculated feeding to levels below $E_{crit}$ can then be normalized to the measured cross section deexciting those levels to determine the total radiative neutron cross-section $\sigma_\gamma$ In this paper we report the cross section measurements in Table 1. We have also determined from our statistical calculations that the neutron capture states in $^{107}$Pd are best described as $2^+[59(4)\%]+3^+[41(4)\%]$. Agreement with literature values was excellent in most cases. We found significant discrepancies between our results for $^{102}$Pd and $^{110}$Pd and earlier values that could be resolved by re-evaluation of the earlier results.

Table 1. Palladium thermal neutron cross sections

| | **Thermal (n,g) Cross Sections** | |
|---|---|---|
| **Isotope** | **This work** | **Literature [3]** |
| $^{102}$Pd | 0.9±0.3 b | 1.82±0.20 [4] |
| $^{104}$Pd | 0.61±0.11 | 0.6±0.3 |
| $^{105}$Pd | 21.1±1.5 | 21.0±1.5 |
| $^{106}$Pd | 0.36±0.05 | 0.29±0.03 |
| $^{107}$Pd | 7.5±0.6 | 7.6±0.4 |
| $^{108m}$Pd(189 keV) | 0.185±0.011 | 0.18±0.03 |
| $^{110}$Pd | 0.10±0.03 | 0.19±0.03 |

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## REFERENCES

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