THERMAL NEUTRON CAPTURE CROSS SECTIONS OF THE PALLADIUM ISOTOPES

R.B. Firestone[1], M. Krticka[2], D.P. McNabb[3], B. Sleaford[3], U. Agvaanluvsan[3], T. Belgya[4] and Zs. Revay[4]

[1] *Lawrence Berkeley National Laboratory, Berkeley, CA 94720*
[2] *Charles University in Prague, Faculty of Mathematics and Physics, V Holešovickách 2, CZ-180 00 Prague 8, Czech Republic*
[3] *Lawrence Livermore National Laboratory, Livermore, California 94551*
[4] *Institute of Isotope and Surface Chemistry, H-1525, Budapest, Hungary*

Precise thermal neutron capture γ-ray cross sections σ_γ were measured for nearly all elements from Z=1-83, 90, and 92 at the Budapest Reactor. These data were evaluated with additional information from the literature to generate the Evaluated Gamma-ray Activation File (EGAF). Isotopic radiative neutron cross-sections can be deduced from the total transition cross section feeding the ground state, $s_0 = S s_g(gs)$ if the decay scheme is complete. The EGAF file contains partial γ-ray cross sections for all stable Palladium isotopes. None of these decay schemes are complete, although in each case transitions de-exciting low-lying levels are known. We have performed Monte Carlo simulations of the Palladium thermal neutron capture decay schemes using the computer code DICEBOX. This program generates a level scheme 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 assuming an *a priori* photon strength function and applying allowed selection rules and a Porter-Thomas distribution of widths. The calculation is then normalized to the measured σ_γ values from EGAF and the total radiative neutron cross-section σ_0 is obtained. Since the measured cross-section de-exciting the lowest levels represents >80% of the total cross section in all cases, DICEBOX needs to calculate only minor missing feeding from the continuum. The σ_0 values derived for the Palladium isotopes agree well with previous measurements and were often more precise. The calculated side feedings from the continuum were compared with the measured intensity balance through known levels. Excellent agreement was found in most cases, and poor agreement in a few cases could be accounted for by plausible adjustments to the level J^π values and transition assignments. Complementary use of γ-ray cross-section data and Monte Carlo calculations has proven effective in determining both the Palladium total radiative cross sections and new nuclear structure information. This work was supported by grants from the Director, Office of Science, Office of Basic Energy Sciences, of the U.S. Department of Energy under Contract No. DE-AC03- 76SF00098; the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48; NNSA Academic Alliance grant No. DE-FG03-03NA00076, and the Grant Agency of the Czech Republic under Contract 202/03/P136.