Evaluations of Cross Sections on Zr, Nb, and W up to 200 MeV for JENDL High Energy File

Satoshi KUNIEDA, Nobuhiro SHIGYO, and Kenji ISHIBASHI

Department of Applied Quantum Physics and Nuclear Engineering, Kyushu University

6-10-1 Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan

The evaluated nuclear data in the intermediate energy range on various nuclei are required for such technologies as high-intensity neutron source, accelerator-driven transmutation system of nuclear wastes, cancer therapy, and space developments. The program for completion of the JENDL High Energy File [1] is now ongoing to meet these needs.

In this work, cross sections were evaluated on ^{90,91,92,94,96}Zr, ^{93}Nb, and ^{182,183,184,186}W for neutron and proton incidence up to 200 MeV. Optical model potential parameters were searched to give good agreements with experimental values of elastic scattering, total, and total-reaction cross sections. The GNASH [2] nuclear pre-equilibrium/statistical model code was used for evaluations of particle production cross sections.

For the nuclear surface localization effects [3] in the exciton model, a reasonable average effective well depth value was adopted. The direct inelastic scattering induced by the excitations of giant resonances is not negligible for medium and heavy nuclei. The evaluations were performed to take them into consideration. For composite particle emission cross sections from pre-equilibrium states, semi-empirical methods developed by Kalbach [4] were utilized. Because there were some problems for calculations of alpha-particle emissions, the original methods (functional forms) were modified to give good agreements with the experimental results. Evaluated cross sections were compared with values by measurements and the LA150 evaluations [5].

[1] T. Fukahori, et al., J. Nucl. Sci. Technol. Suppl., 2, 25 (2002).

[2] P. G. Young, et al., LAUR-88-382 (1988).

[3] C. Kalbach, Phys. Rev., C32, 1157 (1985).

[4] C. Kalbach, Z. Phys., A283, 401 (1977).

[5] M. B. Chadwick, et al., Nucl. Sci. Eng., 131, 293 (1999).