

Measurement of Capture Gamma Rays from the 46- and 84-keV Neutron Resonances of ^{24}Mg

T. Ohsaki, D. Ikenaga[†] and M. Igashira

Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology,

2-12-1-N1-26 O-okayama, Meguro-ku, Tokyo 152-8550, Japan

Tel. +81-3-5734-3378, Fax. +81-3-5734-2959, Email: tohsaki@nr.titech.ac.jp

In general, the measurement of radiative widths of broad neutron resonances is difficult, because the neutrons strongly scattered by the broad resonances cause a huge background in an ordinary experiment. The background reduction and/or separation of true signals from the background are very important to correctly measure the radiative widths of broad resonances. One way to separate the true signals from the background is the observation of distinguished discrete γ -ray transitions from the resonances. For the measurement of γ -rays transitions, NaI(Tl) scintillators are conventionally used. In the present study, we employed a HPGe detector for the measurements of capture γ rays from the narrow 46-keV d-wave and broad 84-keV p-wave neutron resonances of ^{24}Mg for the first time.

The measurement was carried out by using pulsed neutrons obtained from the $^7\text{Li}(p,n)^7\text{Be}$ neutrons by bombarding a Li target with a 1.5-ns pulsed proton beam from the 3-MV Pelletron accelerator of the Research Laboratory for Nuclear Reactors at the Tokyo Institute of Technology. The incident neutron spectrum on a capture sample was measured by means of a time-of-flight(TOF) technique with a ^6Li -glass scintillation detector. The capture sample was a magnesium disk with a diameter of 90 mm and a thickness of 3 mm. A gold sample with a diameter of 90 mm and a thickness of 1 mm was used as a standard. Capture γ rays were detected by a large anti-Compton HPGe spectrometer with a relative efficiency of 100 %. The spectrometer was shielded against background γ rays and neutrons with potassium free lead, borated polyethylene, cadmium and ^6LiH . Two-dimensional data on neutron TOF and γ -ray pulse height from the spectrometer were stored into a PC in a list mode.

For the 46- and 84-keV resonances, 21 and 26 primary γ -ray transitions were observed, respectively. The partial capture kernels were derived corresponding to these transitions. Furthermore the partial and total radiative widths for the broad 84-keV resonance were derived. The present results were compared with measurements by other authors and evaluations.

[†]Present Address: *Panasonic Communications Co., Ltd.*
4-1-6 Minoshima, Hakata-ku, Fukuoka 812-8531, Japan