Paramagnetic Scattering of Neutrons by Rare-Earth Oxides

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Thermal region neutrons are scattered by the paramagnetic moment of rare-earth oxides such as Gd_2O_3 which are contained in nuclear fuels as burnable poison. The scattering is atomic process and not a nuclear process, so the data are not included in the nuclear data files such as ENDF and JENDL. The cross sections and angular distributions of the scattering are calculated using the existing theory[1] and ENDF type files are made for oxides of Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm and Yb. in the incident neutron energy range 10^{-5} - 1.0 eV. Preliminary results of the calculated thermal cross sections are shown in Fig. 1 and an example of the calculated angular distribution is shown in Fig.2 comparing with the experimental results by Koehler et al.[2] For the present calculation, experimentally determined magnetic moments[3] were adopted.
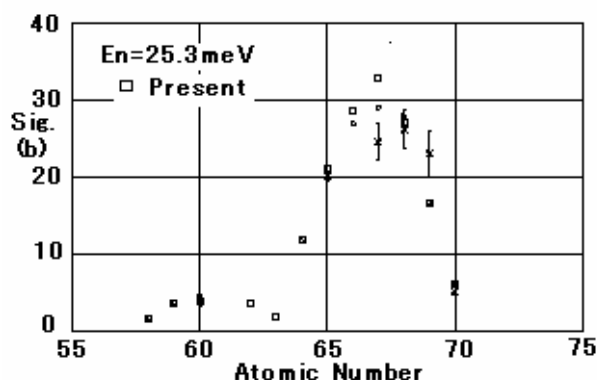

Fig.1 Paramagnetic scattering cross sections of rare earth ions.   Circles and experimental data were those given in Mughabghab's book[4].
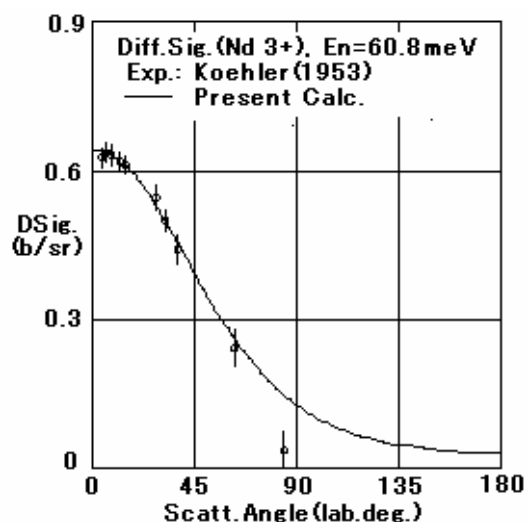

Fig.2 Angular distribution of scattered neutrons by Nd ion (3+). Calculated one is normalized to experimental values.

References

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