

ON THE ENERGY DEPENDENCE OF THE OPTICAL MODEL OF NEUTRON
SCATTERING FROM NIOBIUM*

by

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ABSTRACT

Neutron differential-elastic-scattering cross sections of niobium were measured from 1.5 to 10.0 MeV at intervals of ≤ 200 keV below 4.0 MeV, and of ≈ 500 keV from 4.0 to 10.0 MeV. Ten to more than fifty differential-cross-section values were determined at each incident energy, distributed over the angular range ≈ 20 to 160 degrees. The observed values were interpreted in the context of the spherical optical-statistical model. It was found that the volume integral of the real potential decreased with energy whereas the integral of the imaginary part increased. The energy dependence in both cases was consistent with a linear variation. There is a dispersion relationship between the real and imaginary potentials, and when this was used, in conjunction with the experimental imaginary potential, it was possible to predict the observed energy dependence of the real potential to a good degree of accuracy, thus supporting the consistency of the data and its analysis. The real-potential well depths needed to give the correct binding energies of the $2d_{5/2}$, $3s_{1/2}$, $2d_{3/2}$ and $1g_{7/2}$ particle states and of the $1g_{9/2}$ hole state are in reasonable agreement with those given by a linear extrapolation of the scattering potential. However, the well depths needed to give the observed binding of the $2p_{3/2}$, $1f_{5/2}$ and $2p_{1/2}$ hole states are about 10% less than the extrapolated values.

*This work supported by the U. S. Department of Energy.