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Neutron Scattering from Titanium; Compound and Direct Effects

by

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ABSTRACT

Neutron total and elastic- and inelastic-scattering cross sections of natural titanium were measured. Total cross sections were determined from 0.1-1.5 MeV with resolutions of $\gtrsim$1.5 keV. Differential elastic and inelastic neutron scattering cross sections were measured from 0.3-1.5 MeV with resolutions of $\gtrsim$ 10 keV. The inelastic neutron excitation of states in ^{46}Ti (889 keV), ^{47}Ti (160 keV) and ^{48}Ti (984 keV) was observed. The energy-averaged behavior of the measured results was described in terms of spherical and ellipsoidal optical models and compound-nucleus and direct-reaction processes. The observed fluctuating cross sections were compared with the results of statistical R-matrix calculations based upon the energy-average model parameters and known resonance statistics. It was shown that both compound-nucleus and direct-reaction processes contribute to the fluctuating cross sections and that comparison of calculated and observed fluctuations gave an improved definition of the energy-average models. Furthermore the statistical R-matrix calculations displayed an intermediate resonance structure consistent with experimental observation without recourse to additional reaction mechanisms. The experimental results and their interpretations were used to improve the ENDF/B evaluated nuclear data file.