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The formation of isomeric pair in the natTi(3He,x)44m,gSc reactions: Effect of spin cut-off parameter on the isomeric ratio

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NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION B-BEAM INTERACTIONS WITH MATERIALS AND ATOMS

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Abstract

Excitation functions for the natTi(3He, x)44g,mSc nuclear reactions were measured from respective threshold up to 55 MeV by using a conventional stacked-foil activation technique combined with HPGe gamma-ray spectroscopy. Individual cross-section values for the production of 44mSc and 44gSc were separated using a proper mathematical method on the basis of their individual gamma lines and the data for 44gSc are reported here for the first time. The default parameters of TALYS-1.8 are unable to provide the 44mSc/44gSc isomeric cross-section ratio values consistent with those obtained experimentally. However, an adjustment of the level density model and optical model potentials together with some other relevant parameters, especially the spin cut-off parameter with the variation of eta (=Ieff/Irigid) were found to be effective to reproduce the measured cross-sections. A similar parameter adjustment could be useful for accurate prediction of other medium mass isomeric pairs (i.e., when the metastable state is longer-lived than the ground state) where either experimental data are not available, or an expensive experiment is required to obtain them.

Keywords

Author Keywords: Natural titanium; 3He-particle activation; Stacked-foil technique; Sc isomeric pair; Model calculations

Keywords Plus: INDUCED NUCLEAR-REACTIONS; LEVEL DENSITY; MOMENT

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