Introduction

Even mass Te nuclei in the mass region \(A \sim 130\), have been subject of considerable interest because of their transnational character. In even mass Te nuclei the alignments of valance protons outside the \(^{114}\)Sn core lying in low-\(\Omega\) \(h_{11/2}\) orbitals (proton Fermi surface) drive the nucleus towards prolate shape whereas the aligned neutrons lying in higher -\(\Omega\) \(h_{11/2}\) orbitals (neutron Fermi surface) generally drive the nucleus towards oblate shape. Shape coexistence is one of the interesting characteristic feature of these nuclei.

K-isomers have also been reported in several nuclei with neutron number \(N \sim 74\). Theoretically \(K=8^+\) isomer is also expected in \(^{126}\)Te nucleus [1]. Information on low spin states of \(^{126}\)Te were known from the \(\beta^-\)-decay studies [2]. The band structure of \(^{126}\)Te have been studied via fusion reaction [3] and also via fusion induced fission spectroscopy [4]. Interestingly, placement of several \(\gamma\)-rays do not agree in these measurements [3, 4].

In this work, a detailed re-investigation of the low lying levels of \(^{126}\)Te has been done via fusion evaporation reaction. For complete investigation, \(R_{DCO}\) and Polarization measurements were also carried out.

Experimental Details

In-beam \(\gamma\)-ray spectroscopy of \(^{126}\)Te has been carried out using the 15UD pelletron accelerator [5, 6] at Inter University Accelerator Center, New Delhi. The high spin states in \(^{126}\)Te have been populated via \(^{124}\)Sn(\(^7\)Li, p4n\(\gamma\))\(^{126}\)Te fusion-evaporation reaction at \(E_{\text{beam}}=33\) MeV. Fifteen Compton suppressed clover detectors of Indian National Gamma Array (INGA) [7] have been used to detect the de-exciting \(\gamma\)-rays. The offline data analysis has been carried out using the computer code INGAsort [8]. A number of matrices have been formed by sorting of the gain matched list mode data in order to carry out the \(\gamma-\gamma\) coincidence and angular correlation data analysis.

Results and Discussion

FIG. 1: Partial level scheme of \(^{126}\)Te.

In the present study, the 208 keV and 989 keV \(\gamma\)-transitions of the ground state band (as marked in figure 2.) were altered with respect to their earlier position in the previously reported level scheme [3]. The present modified level scheme of \(^{126}\)Te nucleus is shown in figure 1. The placement of these two transitions

*Electronic address: hpsharma07@yahoo.com
FIG. 2: Plot shows 666 keV energy gate in which important $\gamma$-rays belonging to $^{126}$Te nucleus are marked with their energies.

FIG. 3: Plot shows the $R_{DCO}$ values of various $\gamma$-transitions belonging to $^{126}$Te, determined from the energy gates of 666 keV and 695 keV quadrupole transitions.

was also agree with the placement reported by Astier et al [4]. In addition to this, a 1035 keV transition was also placed above $6^+$ state at 1775 keV by Pasi et al [3] . The placement of this transition also changed in present work and now placed above $4^+$ state at 1361 keV in the g.s. band and corresponding energy of the new level was found to be 2396 keV. From the same 2396 keV level, another 621 keV $\gamma$-transition was also found decaying to $6^+$ state at 1775 keV of the g.s. band.

The multipolarity of several $\gamma$-rays have been assigned on the basis of Directional Correlation of Oriented states (DCO) ratio, determined from angular correlation measurement.

$$R_{DCO} = \frac{I_{\gamma_1} at \theta_1, \text{ gated by } \gamma_2 at \theta_2}{I_{\gamma_1} at \theta_2, \text{ gated by } \gamma_2 at \theta_1}$$

The present $R_{DCO}$ values as shown in figure 3, confirm the quadrupole and dipole nature of several prominent $\gamma$-transitions and agree with earlier works [3, 4]. In order to extract the information on configurations of the observed band structures detail analysis of the experimental data for $R_{DCO}$ and polarisation measurement is under way.

Conclusion

The excited states of $^{126}$Te were populated via $^{124}$Sn($^7$Li, $p4\gamma$)$^{126}$Te fusion-evaporation reaction and few new $\gamma$-lines were identified and placed in the level scheme. Also, the position of few earlier placed $\gamma$-transitions were changed in the present work. The multipolarity of several prominent $\gamma$-transitions were determined from angular correlation data ($R_{DCO}$) and used for spin assignment.

Acknowledgment

The authors are thankful to the staffs of the target lab, Pelletron accelerator and INGA facilities at IUAC. The first author also thankful to the UGC for financial support vide contract no. 23/06/2013(I)EU-V.

References