Excited states of ^{126}Te and ^{129}Xe

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Many nuclei with neutron number $N \sim 75$ has been found to have K isomers. In particular, the nucleus ^{126}Te has been theoretically predicted to be a good candidate for K isomerism by Xu *et al.* [1]. Earlier the low spin states of ^{126}Te were known through the β-decay of ^{126}Sb. In a fusion-fission experiment by Smit *et al.* [2], the excited states of ^{126}Te up to 8^+ were observed. Experimentally, the high spin states of such a nucleus which is close to the β-stability line is difficult to populate using the conventional fusion evaporation reaction with the stable projectile and target combination. However, the incomplete fusion reaction offers an attractive alternative. For ^{129}Xe, the in-beam study was limited to only low spins [3]. Here we present the results of our experimental investigation of ^{126}Te populated *via* incomplete fusion α-channel and ^{129}Xe populated *via* compound nuclear fusion 4n-channel in the same experiment.

A γ - γ coincidence experiment with four HPGe clover detectors was performed using a target of ^{124}Sn and ^{9}Be beam of energy 46 MeV delivered by the Pelletron accelerator at Tata Institute of Fundamental Research, Mumbai. A self-supporting target of thickness 2 mg/cm^2 was used. The data were collected in the list mode.

In the data analysis, after energy calibration, gain matching, the E_γ *vs.* E_γ matrix was constructed. The total projected spectrum was created, as shown in Fig.1. The labelled γ lines belong to the residues formed in the reaction. The projected spectra with specific energy gates were generated. One example of such spectrum with the gate on 747 keV transition is shown in Fig. 2. This is a newly found transition in ^{129}Xe.

We calculated the cross-sections for the residues formed in the compound nuclear reaction at different beam energies using the computer code PACE. The results are plotted in Fig. 3. From this plot, we found that the formation cross-section of ^{126}Te through compound nuclear reaction was very small as compared to that of $^{128,\ 129}$Xe at the beam energy of 46 MeV. However, in our experimental spectrum shown in Fig. 1, we found the intensity of the gamma lines belonging to ^{126}Te to be quite intense. For example, two gamma transitions belonging to ^{126}Te with energy values 414 keV ($6^+ \rightarrow 4^+$) and 666 keV ($2^+ \rightarrow 0^+$) have the intensity values almost one third of 443 keV which is the ground state transition in ^{128}Xe. We inferred that the formation of ^{126}Te was mainly though the incomplete fusion reaction. We are currently in the process of placing new gamma transitions in the decay scheme of ^{126}Te [2].

We have isolated many gamma lines which are coincident with the known gamma transitions belonging to ^{129}Xe. States up to $23/2^-$ were known earlier [3]. So far, we have placed 6 new transitions in the decay scheme, marked as * in Fig. 4. The placement of the dashed transition is placed tentative, and further analysis is in progress.

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References

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Fig 1

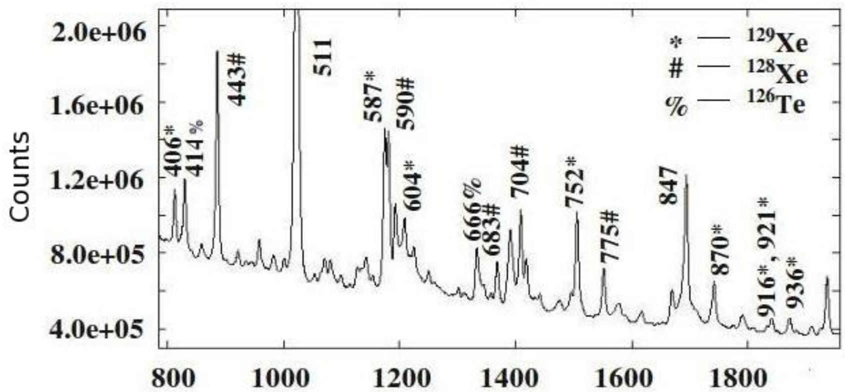

Fig. 2

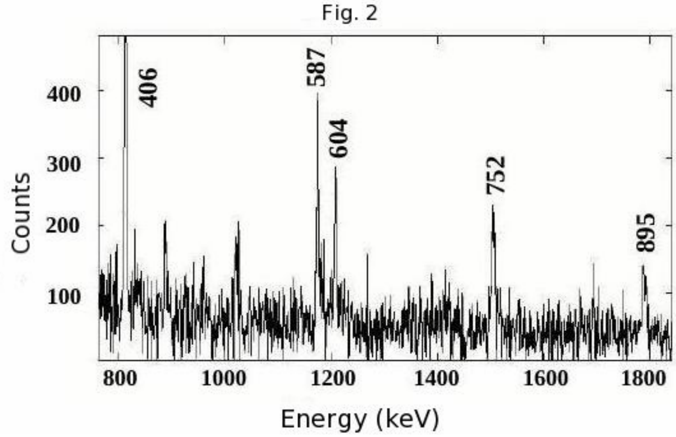

Fig. 3

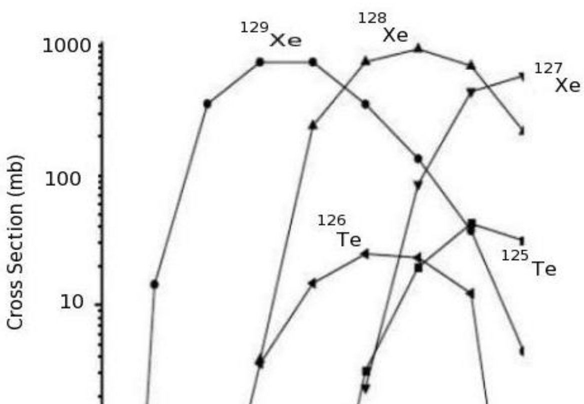

Fig. 4