RDM Lifetime measurement in ^{103}Pd

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Introduction

The Pd nuclei with A $\sim$ 100 are rich in nuclear structure properties. In the experimental investigations the Pd nuclei are found to possess the vibrational character at low spins while at high spin, interesting new features like band termination, magnetic rotation (MR) band and chirality have been observed [1-4]. The calculations [5] suggest changing nuclear shape from spherical-deformed (in A $\sim$ 100) to the γ- soft (in A $\sim$ 110) as the possible reason for such interesting structural features at high spins in Pd isotopes. In ^{103}Pd [3], band-termination has been observed at high spins in the yrast band. In the band-termination, angular momentum evolves from a purely collective rotation at the bandhead to a pure single-particle configuration at the terminating spin and as a result the quadrupole moment (or B(E2)) values along the band decrease with spin. So measuring B(E2) values with spin along the yrast band in ^{103}Pd would not only reveal the changing nuclear shape along the yrast band, but also would help in understanding the cause of observed band termination in this nucleus. With this motivation, recoil distance lifetime measurement [6] experiment in ^{103}Pd nucleus has been performed at the Inter University Accelerator Center (IUAC), New Delhi.

In the experiment ^{94}Zr(^{12}C, 3n)^{103}Pd reaction, at a beam energy of 57 MeV has been used. Data at 23 distances, ranging from 10 μm to 6.82 mm was taken. The emitted γ-rays were detected with 5 Compton suppressed HPGe detectors arranged in two different rings of 3 detectors making an angle of 144^0 and other two detectors making an angle of 50^0 with respect to the beam axis respectively. For each target-stopped distance, the data was taken in the single mode. The data analysis was done with the computer code, LIFETIME [7]. The results (preliminary) of the analysis are very encouraging and indicate a different scenario for the yrast sequence in ^{103}Pd nucleus. Fig. 1 shows the nature of the shifted and unshifted peaks with D_{T-S} of 477 keV ($\frac{15}{2}^- \rightarrow \frac{11}{2}^-$) peak of yrast band in ^{103}Pd obtained in the experiment. The mean-lifetime value [29.8(11) ps] of the $I = \frac{15}{2}^-$ state in ^{103}Pd obtained in the present data analy-

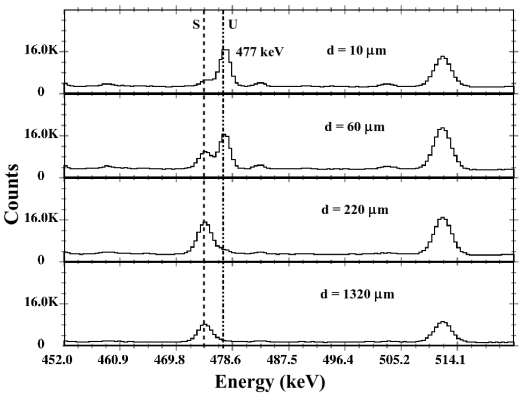

FIG. 1: The shifted (S) and unshifted (U) peaks of γ-ray transition 477 keV for different D_{T-S} of a backward HPGe detector at 144^0 with the beam direction.

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TABLE I: Summary of the results obtain in the preliminary data analysis, where E_γ is the energy of γ-ray and ${I_i}^\pi \rightarrow {I_f}^\pi$ denotes the spins and parities of the initial and final state.

E_γ(keV)	${I_i}^\pi \rightarrow {I_f}^\pi$	Lifetime, τ (ps)		B(E2) $[10^{-2}(\text{eb})^2]$	
		Old work	Present work	Old work	Present work
477	$\frac{15}{2}^- \rightarrow \frac{11}{2}^-$	31.2(44)	29.8(11)	10.6(14)	11.0(4)
714	$\frac{19}{2}^- \rightarrow \frac{15}{2}^-$	-	8.88(47)	-	4.9(3)
847	$\frac{23}{2}^- \rightarrow \frac{19}{2}^-$	-	4.27(50)	-	4.4(4)

sis is consistent with the value 31.2(44) ps reported by S. F. Ashley et al. [8]. The results of the data analysis are shown in Table 1.

Acknowledgments

The authors wish to acknowledge the contribution of the Pelletron staff for providing the good quality of beam during the experiment. C.K. Gupta wishes to acknowledge the financial assistance by University Grants Commission (UGC), India.

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