DSAM analysis of ^{104}Pd

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Introduction

Study of nuclei from A$\sim$ 110 mass region is important due to presence of phenomena like γ vibrational bands, doublet bands, chiral bands, antimagnetic rotational bands. [1–3]. Pd nuclei are situated between well-deformed and spherical nuclei at Z = 50 shell closure and predicted to be soft *w. r. t.* γ and β deformations [4]. It is interesting to verify the theoretical predictions about Pd nuclei at low and at high spin.

Lifetime measurement is one of the best tool to study the deformation, transition rates and structure of nuclei. Previously, lifetime measurement was reported and AMR was established in several nuclei[1, 3, 5, 6]. In this study, we report lifetimes of states of the AMR band (B1) and a negative parity semi-decoupled band (B2) in ^{104}Pd (marked blue in Fig.1).

Experimental details and Data analysis

High spin states of ^{104}Pd were populated via the ^{94}Zr(^{13}C, 3nγ) reaction at beam energy 55 MeV with 15UD pelletron accelerator facility [7, 8] at Inter University Accelerator Centre (IUAC), New Delhi. The beam was impinged on a target of 1 mg/cm^2 thickness, supported by 10 mg/cm^2 thick ^{197}Au backing. The emitted gamma rays were detected using clover detectors of the Indian National Gamma Array, at angles 32^0, 57^0,90^0, 123^0, 148^0 w.r.t. beam direction [9].

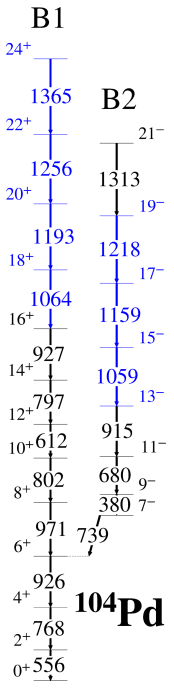

FIG. 1: Levels of band 1 and 2 in ^{104}Pd.

Several assymetric matrices were constructed from the list data. Out of five angles, matrices were constructed for two angles (90^0 and 148^0). The background subtracted spectra of several transitions of interest were projected from these matrices. Lifetime of states were extracted using Doppler Shift Attenuation Method (DSAM) and for fitting, the computer code LINESHAPE [10] was used. The slowing down history of the recoils (moving with an initial recoil velocity of β = 0.0098 in present case) in the target and backing were simulated using a Monte Carlo technique, having 5000 histories with a time step of 0.006 *ps*.

The shell-corrected stopping power of Northcliffe

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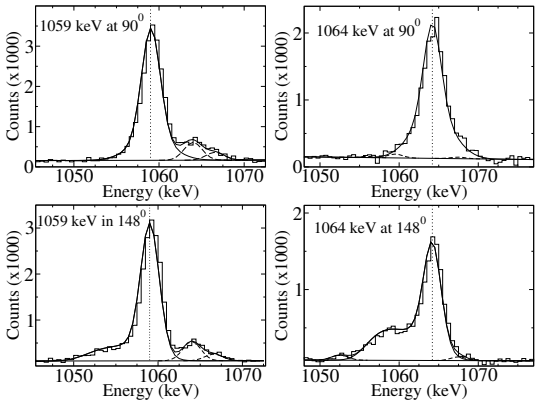

FIG. 2: Sample of lineshape fitting of 1059 *keV* and 1064 *keV* transitions, gated on 380 *keV* and 802 *keV* at 90^0 and 148^0 respectively.

and Schilling [11] was used. The error spectra were generated by setting the energy gates on the background near the transitions. The 100% side-feed contribution was assumed for the top most transition and for the lower transitions, side feeding intensities are estimated from previously reported intensities [1]. All parameters were allowed to vary until χ^2 minimization was reached. From the best fit of least square fitting of the shapes of the transitions, lifetimes were extracted. In this work, previously reported lifetimes of band B1 were reproduced well and first time, lifetime of the states of B2 band were extracted.

Results and Discussion

Lifetime measurements have been carried for ground state band and negative parity semi-decoupled band using DSAM technique. The previously reported lifetimes of the AMR band were reproduced. First time lifetimes of band B2 were extracted. Samples of lineshape fittings of the 1064 *keV* transition of the B1 band and 1059 *keV* transition of the B2 band are shown (Fig2). Results of lifetimes are summarised at table. More details of the analysis and results will be presented during the symposium.

Conclusion

Previously reported lifetime has been reproduced and lifetime of some states of semi-decoupled band are reported first time.

	I^π ($\hbar$)	E_γ(keV)	Lifetime [a](ps)	Lifetime [b](ps)
B1	18^+	1064	0.26 (20)	0.27 (2)
	20^+	1193	0.19 (9)	0.18 (2)
	22^+	1256	0.22 (4)	0.20 (2)
	24^+	1365	0.23 (19)	0.24 (3)
B2	15^-	1059	0.16 (8)	-
	17^-	1159	0.44 (18)	-
	19^-	1218	0.12 (5)	-

[a]from present work
[b]from Ref. [12]

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