High spin states of $^{167}$Tm were populated in the fusion of 55MeV $^7$Li ions with a $^{164}$Dy target. The GASP $\gamma$-detector array at the INFN Laboratory, Legnaro, Italy was used for this work. The present data has allowed the yrast decay sequence of $^{167}$Tm to be seen to spin $61/2$ $\hbar$. The $1/2[411]$ ground state band has been extended to $51/2$ $\hbar$ and the $7/2^+[404]$ and $7/2^-[523]$ bands have been extended to spin $43/2^+$ and $39/2^-$ respectively.

The experiment conducted at LNL was designed to study the incomplete fusion of $^7$Li ions with $^{164}$Dy, yielding neutron-rich Er isotopes around mass 166. An offshoot of the experimental data was the production of $^{167}$Tm in the fusion-evaporation reaction involving 4n evaporation.

**EXPERIMENTAL RESULTS**

The Tandem-XTU accelerator was used to accelerate $^7$Li ions to 55MeV. The isotopically enriched $^{164}$Dy target was of thickness 3.5 mg·cm$^{-2}$. The fusion evaporation reaction yielded a few exit channels of which $^{165,166,167}$Tm were populated by the evaporation of six, five and four neutrons respectively, with the 4n channel yielding the most new data. The high efficiency and resolving power of the GASP multi-detector $\gamma$-ray array yielded good statistics. The cross section for the 4n reaction channel leading to $^{167}$Tm was ~20mb corresponding to ~5x$10^9$ $\gamma\gamma\gamma$ events. The trigger conditions for an ‘event’ corresponded to two or more unsuppressed Ge signals and two or more BGO inner-ball element signals. The data were sorted into a $\gamma\gamma\gamma$ cube and analysed using the RADWARE analysis package.

Prior to the current ($^7$Li, 4n) experiment, the $^{167}$Tm nucleus has been studied by Olbrich et al [1] (using the $^{165}$Ho($\alpha$, 2n)$^{167}$Tm reaction) in which the $1/2^+[411]$, $1/2^+[541]$, $7/2^+[404]$ and $7/2^-[523]$ bands were all extended to spin $31/2^+$. More recently Jensen et al [2] have studied the $^{124}$Sn($^{48}$Ca, p4n)$^{167}$Tm fusion evaporation reaction in which the $\pi h_{9/2}[541]$ ($\nu l_{13/2})^2$ decay sequence was strongly populated and the favoured signature ($\alpha=1/2$) was extended to spin $61/2^+$ (tentatively to $65/2^+$). The signature splitting in this band is large and the $\alpha=-1/2$ signature is consequently very weakly populated.

In the present work, rotational sequences based on the $1/2^+[411]$, $7/2^+[404]$ and $7/2^-[523]$ Nilsson states have been extended to high spin, figure 1. The $1/2^+[541]$ band was identified to spin $61/2^+$ in confirmation of previous work. The $\alpha=-1/2$ signature of the $1/2^+[411]$ ground state band has been extended by five transitions to spin $51/2^+$ and its signature partner to spin $41/2^+$. The $7/2^+[404]$ band has been extended to spin $43/2^+$ by adding three new $\gamma$-rays to the $\alpha=1/2$ signature and the $\alpha=1/2$ signature has had two new levels added to take it to spin $37/2^+$. The $7/2^-[523]$ band has had two new transitions added to both signatures, increasing the band to spin $39/2^-$. A comparison of the experimental routhians and alignments with the results of Cranked Shell Model calculations is currently under way and a paper is being prepared for publication.

**REFERENCES**


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