Recoil-Isomer Tagging of Extremely Neutron-Deficient Nuclei, ^{142}Tb and ^{144}Ho

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Excited states in the neutron-deficient odd-odd nuclei ^{142}Tb and ^{144}Ho have been populated using the ^{92}Mo(^{54}Fe,3pn)^{142}Tb and ^{92}Mo(^{54}Fe,pn)^{144}Ho reactions and studied using the recoil-isomer tagging technique. The beam was supplied at energies between 226 and 265 MeV by the K130 cyclotron at the University of Jyväskylä, Finland. The JUROGAM and GREAT detector arrays were employed with the RITU gas-filled recoil separator to study these nuclei using γ-ray spectroscopy. Recoil distance Doppler-shift (RDDS) lifetime measurements have been performed on the states above the ^{144m}Ho isomer using the Köln differential plunger. This measurement represents the first differential-plunger lifetime measurement to utilize recoil-isomer tagging to isolate the nucleus of interest.

Potential energy surface calculations predict these nuclei to have axially asymmetric and γ-soft shapes and the data have been interpreted within the framework of the cranked-shell model. The properties of the rotational bands above the $I^{\pi} = 8^{+}$ isomers in ^{142}Tb and ^{144}Ho indicate that these states are based on $\pi h_{11/2} \otimes \nu h_{11/2}$ two-quasiparticle configurations. The data show good agreement with the predicted axial asymmetry for these nuclei.

A lifetime of 6(1) ps was determined from the RDDS measurements for the $I^{\pi} = 10^{+}$ state above the ^{144m}Ho isomer. The lifetime of this state can be understood from these calculations if a degree of rotational alignment is invoked for this band, with the K value being lower than the bandhead spin. However, the validity of the K quantum number with large predicted triaxiality and softness requires further theoretical study.