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Study of High-spin States in $^{49-51}$Ti

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In nuclei near closed shell, shell structure can be studied by looking at high-spin states. At excited states with certain amount of spins, these nuclei need to promote nucleons across the shell gap in order to gain larger angular momentum. Such core excitation across the N=28 shell gap have been previously discussed in even-even nuclei of N=28 isotones both experimentally and theoretically [1,2]. In order to study shell structure in neutron-rich Ti isotopes, $^{49-51}$Ti, we have performed in-beam γ-ray spectroscopy. In order to realize high-spin studies in neutron rich nuclei by fusion-evaporation reaction, we need to use neutron-rich secondary beam, since it is difficult to access high-spin states in such nuclei with stable beam and stable target combinations.

The experiment was performed at the RIPS beam line in RIKEN [3]. A ^{46}Ar beam was produced by projectile fragmentation of ^{48}Ca at the energy of 64 MeV/A, and its energy was lowered to a few MeV/A using an aluminum degraders. A ^{9}Be target of 1.84 mg/cm^2 was used to bombard the ^{46}Ar beam to make fusion reaction, $^{9}\mathrm{Be}\left(^{46}\mathrm{Ar}, xn\right)^{55-x}\mathrm{Ti}$.
Details on the production of low-energy secondary beam are reported in ref. [4]. Gamma rays emitted from high-spin states of evaporation residues were detected by the CNS Gamma-Ray detector Array with Position and Energy sensitivity (CNS-GRAPE) [5].

The experiment involved the measurements of excitation functions, γ-ray angular distributions and γ-γ coincidences, and high-spin levels up to (21/2), (11+), and (17/2) states in $^{49-51}$Ti were identified, respectively. Shell-model calculations suggest that these high-spin levels were created by promoting one neutron across the N=28 shell gap. In the talk, shell structure around N=28 will be discussed.

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