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In-beam γ-ray spectroscopy of ^{38,40,42}Si

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Excited states in the nuclei ^{38,40,42}Si have been studied using in-beam γ-ray spectroscopy following multi-nucleon removal reactions [1] to investigate the systematics of excitation energies along the $Z = 14$ isotopic chain. The $N = 28$ isotope ^{42}Si can be regarded as a magic nucleus in the traditional shell model since a large energy gap exists at $N = 28$ due to the spin-orbit splitting. The disappearance of the $N = 28$ shell closure together with a large deformation, however, has been suggested from the observation of a low energy 2^+_1 state [2]. Several experiments have been performed to investigate the structure of ^{42}Si so far [2-5], but no experimental data have been reported on higher-lying states, which may contribute valuable information on the nature of the collectivity and/or shell evolution. In order to study these states, we performed multi-nucleon removal reactions with radioactive isotope beams of ^{40}S and ^{44}S at the RI Beam Factory accelerator complex operated by the RIKEN Nishina Center and CNS, University of Tokyo. Owing to the high secondary beam intensities, several γ-ray lines, which include candidates for the $4^+_1 \rightarrow 2^+_1$ tranditions, were observed for the first time in addition to the $2^+_1 \rightarrow 0^+_{g.s.}$ γ-ray transitions. We will report on the tentative spin-parity assignments of the observed excited states and discuss the evolution of nuclear structure toward the $N = 28$ isotope ^{42}Si, where the magicity loss was previously suggested [2,3]. A part of results were reported in Ref. [1].

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