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Cryogenic hydrogen gas target for a measurement of neutron inelastic scattering in ^{12}C

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The triple alpha process is an essential reaction in nucleosynthesis. In a hot and dense environment, the reaction rate can be enhanced by neutron upscattering process. In that process, the Hoyle state in ^{12}C decays into the bound states by giving the excitation energy to neutrons instead of radiation decay. We plan to measure a cross section of the inverse reaction in order to determine the enhancement factor. For the measurement, we developed a cryogenic hydrogen gas target to produce a high-intensity monoenergetic neutron beam. The hydrogen gas is cooled to below 77 K by a GM refrigerator and approximately 10 MeV neutron beam is produced by $^{1}\mathrm{H}(^{13}\mathrm{C},\mathrm{n})^{13}\mathrm{N}$ reaction at $E_{^{13}C} = 72.7\,\mathrm{MeV}$. We performed a thermal test of the cryogenic target with heaters to simulate the primary beam energy loss. In addition, we also conduct a performance test of the target using an actual beam. I will report the development of the gas target and results of two performance tests.

Primary author: YAMAZAKI, Shumpei (CYRIC Tohoku University)

Co-authors: ITOH, Masatoshi (CYRIC Tohoku University); ADACHI, Satoshi (CYRIC Tohoku University); YONEKURA, Shohei (CYRIC Tohoku University); HOSOYA, Genki (CYRIC Tohoku University); SAITO, Ryota (CYRIC Tohoku University); KAWABATA, Takahiro (Department of Physics, Osaka University)

Presenter: YAMAZAKI, Shumpei (CYRIC Tohoku University)

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