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Properties of Thick-GEM in Low Pressure Deuterium

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Nuclear incompressibility is an important quantity in understanding the equation of state (EOS) of nuclear matter. To extract the nuclear incompressibility of neutron rich nuclei experimentally, one has to detect particles whose kinetic energies as low as a few hundred keV. For the purpose, CNS (Univ. of Tokyo), RIKEN and other universities have developed GEM-TPC based active target, CNS Active Target (CAT) for missing mass spectroscopy in inverse kinematics. If we choose deuterium as an active gas target, (d, d') reaction can be used. Basically, an active target has an outstanding benefit for a detection of very low energy particles. On the other hand, such particles runs within too short range in 1 atm gas target. For instance, 250 keV deuteron flies only 18 mm in 1 atm deuterium and it is insufficient to track the particle. Therefore, it is necessary to make the range of low energy particles longer to track precisely those particles. Usually, thick-GEM is used in a low-pressure condition, because thin GEM, such as standard CERN-GEM [1] hardly provides an enough gas gain in low pressure gas [2]. However, there were no references to investigate properties of thick-GEM in low-pressure deuterium. In this study, basic properties of 400μm-thick GEM in low-pressure deuterium were investigated. To have an enough gas gain, we have to employ multiple GEMs and we used double thick-GEMs. The achieved gas gain was around 1000. Not only electric field over pressure (E/p) dependence of gas gain but also electric fields of drift, transfer and induction region dependences were investigated. If the gas gain relies only on the E/p, there should be almost same gain in terms of E/p in various pressures for a constant ratio of electric fields. However, we found disagreements of gas gain at the same E/p value. This phenomenon could be explained by the effect of the "threshold"electric field where the multiplication starts. The gain stability was also measured and it showed about a ten-percent of sigma deviation. Those details will be presented in this talk. [1] F. Sauli, Nucl. Instr. And Meth. A 386 (1997) 531. [2] S.K. Das et al., Nucl. Instr. And Meth. A 625 (2011) 39.

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