Abstract

Project Code: TRG5780292

Project Title: Performances of the Gas Electron Multiplier (GEM)-Based Neutron Detector using Solid Neutron Converters

Investigator: Dr. Kiadtisak Saenboonruang

E-mail Address: fscikssa@ku.ac.th

Project Period: 15 July, 2014 – 14 July 2016

Abstract: The gas electron multiplier (GEM) detector is a gaseous detector that has been utilized for almost 20 years. Since the discovery in 1997 by F. Sauli, the GEM detector has shown excellent properties including high rate capability excellent resolution, low discharge probability, and excellent radiation hardness. These promising properties have led the GEM detector to gain popularity and attention amongst physicists and researchers. In particular, the GEM detector can also be utilized as a neutron detector. Applications of the GEM-based neutron detectors vary from researches in nuclear and particle physics, neutron imaging, and national security. To enable the GEM detector to detect neutrons, an appropriate neutron converter must be added to the detector. Boron-10, which has relatively high neutron cross section compared to other available neutron converters, is a perfect candidate to be used for this purpose. In this research, different thicknesses of pure boron-10 and natural boron films were coated onto a GEM drift cathode such that incoming neutrons could interact via nuclear reactions with boron-10 and produce alpha particles to ionize gas molecules for detection. Results showed that a 1-μm boron-10 film and 2.5-, 3.5-, 4.5-μm natural films coated on the GEM drift cathode were able to detect neutrons emitted from ^{241}Am/Be, with a 1-μm boron-10 film giving the highest relative efficiency. Efficiencies and gains of the GEM detector increased as the power supply increased, while the efficiencies reached plateau region when the power supply was ~4,200 V. These results indicated the success of using the GEM detector with solid neutron converters to detect neutrons and outcome of the research could be used for future references and researches.

Keywords: Gas Electron Multiplier**,** GEM, neutron, solid neutron converter, boron, radiation