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The Recent Results of Glass Gas Electron Multiplier

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The glass gas electron multiplier, glass gem (G-GEM), is a GEM based detector which is composed of a photoetchable glass substrate (PEG3, HOYA Corporation, Japan). Its improved spark tolerance and mechanical stability provides better handling and simple detector setup. No outgassing from the substrate enables the long-term sealed operation of detectors.

In this research we report on the recent results of a new G-GEM composed of crystalized photoetchable glass (PEG3C). PEG3C is a crystalized type of PEG3 glass. The crystalization process is done by heat treatment. Its improved mechanical robustness (higher young's modulus and bending stress) enables arbitrary design of a detector such as a G-GEM with thinner substrate. The less deflection of the detector across its sensitive area is also achievable.

We designed a crystalized G-GEM with the geometry of 680 micro-meter thickness, 280 micro-meter hole pitch, and 170 micro-meter hole diameter. We investigated the basic characteristics of this crystalized G-GEM. The maximum effective gas gain of 25000 was achieved with a single stage G-GEM in Ar/CO₂ 90/10 gas mixture. The maximum gain was the similar value of that of non-crystalized G-GEM. The gain stability was also investigated. The gain decreased 20 % in the timescale of 30-60 minutes after applying high delta-V across the G-GEM, then it reached the plateau. The energy resolution of 24 % (Fe-55, 5.9 keV) at the gain of 6300 was obtained. We demonstrated an X-ray radiography of a small mammal with the analogue readout system. The spatial resolution of 110-130 micro-meter in sigma was obtained.

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