Contribution ID: **43** Type: **not specified**

Integration of CVD graphene in Gaseous Electron Multipliers for high energy physics experiments

Thursday 15 December 2022 09:50 (20 minutes)

To enhance the performance of micro-patterned gaseous detectors (MPGDs) to meet the challenging requirements of future HEP experiments, 2D materials are attractive candidates to address the backflow of positive ions (ion backflow, IBF), which affects detector performance by distorting electric field lines. A single or few layers of graphene are promising to work as selective filter for IBF suppression [1,2]. Thanks to its delocalized carbon's π-orbitals, graphene may block any ions while it is expected to be transparent to electrons traversing the sheet in a perpendicular direction. Here we present an approach to integrate chemical vapor deposition (CVD) graphene [3] on gaseous electron multipliers (GEMs) prototypes via a wet transfer procedure. Typical hole diameters of tens of μm diameter make the suspension of single or few layer graphene membranes across such areas challenging due to process steps involving liquids mostly related with the capillary effects during drying and evaporation of them. In order to overcome the risk of damaging the membrane and decreasing the yield of suspended 2D material membranes, critical point drying (CPD) and inverted floating method procedures are investigated, see figure1 [4]. In addition to the necessity to cover the full holes in the active area, polymeric residuals have to be minimized in order to evaluate the graphene transparency at the electron energies (i.e., <15 eV) typically obtained in MPGD operating conditions, measurements in these energy ranges are still missing. The advantages of having graphene membranes to physically separate drift and amplification regions of the detectors in order to profit from additional flexibility in the choice of gas mixtures, thus allowing independent optimizations of detector sensitivity and electron multiplication processes will be also discussed. Figure1. SEM images of a GEM foil after graphene bilayer transfers. (a) 2D material membranes are completely broken after the natural drying of the solvents; (b) Fully covered sample after removing the polymeric layer via an inverted floating method procedure; (c) Micrograph of a single hole showing the residuals left on top of the membrane during the transfer procedure. References: [1] Michael Doser et al., Front. Phys. https://doi.org/10.3389/fphy.2022.887738, 2022 [2] S. Franchino et al., Nuclear Instruments and Methods in Physics Research Section A, https://doi.org/10.1016/j.nima.2015.11.077 [3] V Miseikis et al 2015 2D Mater. 2 014006 https://doi.org/10.1088/2053-1583/2/1/014006 [4] Afyouni Akbari et al., Sci Rep 10, 6426 (2020). https://doi.org/10.1038/s41598-020-63562-y

Presenter: ORLANDINI, Giorgio (Friedrich Alexander Univ. Erlangen (DE))

Session Classification: Session 9