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Thermal neutron detection based on resistive gaseous devices

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The uRANIA project aims to realise a compact device for thermal neutron detection, utilising resistive gaseous devices such as μ-RWELL and surface Resistive Plate Counter (sRPC).

The μ-RWELL is a single amplification stage resistive MPGD. The amplification stage, based on the same foil used for GEMs, is embedded through a resistive layer of Diamond-Like-Carbon (DLC) in the readout board. On the copper-coated side of the foil a well matrix is realized (70 μm diameter, 140 μm pitch). A thin layer of 10B4C (sputtered on different 2D or 3D geometries) enables thermal neutrons conversion into 7Li and α ions, which can be detected. Testing with various layouts has demonstrated that a single detector can achieve up to 7% efficiency for thermal neutrons (25meV). A detailed comparison between experimental data and the simulation of the detector behaviour has been performed.

Concurrently, the development of thermal neutron RPCs, based on an innovative concept, is underway. The sRPC is an RPC based on surface resistive electrodes realized by exploiting DLC sputtering technology on thin polyimide foils, the same used for μ-RWELLs. The DLC foil is glued to a 2mm thick float-glass. The 2 mm gas gap between the electrodes is ensured by Delrin® spacers, inserted without gluing at the edges of the glass. This electrode assembly is then encased within a fiberglass box, defining the gas volume.

Replacing one or both DLC electrodes of the sRPC with 10B4C coated plates, the device becomes sensitive to thermal neutrons. Three different combinations of 10B4C electrodes have been tested: coating cathode, anode or both. With these symmetric layout an efficiency of 6% has been achieved. The robustness, ease of construction, and scalability of the sRPC technology pave the way for a cost-effective solution for large area detector units as required for example by applications in homeland security.

Collaboration

Role of Submitter

I am the presenter

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