

A neutron detector with RWELL in ^3He - CF_4 gas mixtures

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The MSGC was the earliest MPGD and the only type found able to operate in ^3He - CF_4 gas mixtures with a CF_4 partial pressure of several atmospheres. This was until our work on the μRWELL , the most recently developed MPGD. Our investigations were the first to test ^3He as a neutron converter with the μRWELL and we found we could safely use at least six bar of CF_4 . Despite the ^3He shortage, it is essential to persevere in the development of detectors for neutron scattering applications based on this gas as it provides the easiest method of obtaining high detection efficiency. To achieve sub-millimetre position resolution, at least 4 bar of CF_4 is required as a stopping gas in order to adequately reduce the range of the charged particles emitted after the neutron absorption reaction. High-efficiency and sub-millimetre position resolution together with the high-rate capabilities typical of an MPGD make the μRWELL used with a ^3He - CF_4 gas mixture the ideal solution for many applications in neutron scattering instruments, such as small angle scattering, reflectometry and imaging. Here we report on gain measurements from the μRWELL using gas mixtures of up to six bar of CF_4 and 1 bar of ^3He , as well as stability and rate capability measurements done on the prototype used for these measurements. Additionally, we report on the optimisation of the drift field, which needs to be sufficiently high to prevent primary electron attachment in the drift volume but not at a level which restricts primary electrons from entering the holes of the μRWELL .

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