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11. An SU-8 Delayed Development Processing Technology for MPGD

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SU-8 is a high-contrast, epoxy-based photoresist designed for micromachining and other microelectronic applications where a thick, chemically, and thermally stable image is desired.µGroove is a high-performance single-stage MPGD featuring a groove amplification pattern, typically fabricated by chemical etching. In this study, we present the process of μ Groove with smaller amplification units on a quartz substrate using SU-8. Specifically, SU-8 served as a sacrificial layer, and an Al film acted as a supporting layer. During the exposure of the positive photoresist, the negative photoresist SU-8 was also exposed synchronously without any positional offset. Finally, through delayed development of SU-8, we achieved self-alignment of the cathode metal layer (aluminum) and the SU-8 supporting layer, completing the prototype with a groove pitch of 140µm, a width of 70µm, a thickness of 50µm for SU8 and 100nm for Al. When read from the cathode, the effective gain of the induced signal can reach up to 1600, with an energy resolution of approximately 9.5%. By fixing the detector voltage at 370V and scanning the drift electrode, the gain increases almost linearly with the drift electrode voltage, with the energy resolution also around 12%. Based on the delayed development technology of SU-8, we also explored some MPGD structures, such as Micromegas and µRGroove on PCB. Due to the high precision of the SU-8 photolithography process, it is possible to fabricate microstructures with smaller granularity and effectively bond them with readout chips, showing potential in the field of ultra-high precision detection.

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