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One-Side-Electrode-Type Fluid-Based Inclinometer Combined with Complementary Metal Oxide Semiconductor Circuitry

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In this study, electrical double layer theory is applied to realize a one-side-electrode -type fluid-based inclinometer combined with complementary metal oxide semiconductor (CMOS) circuitry. Substrate penetration lithography was applied in the fabrication of high-aspect-ratio SU-8 container molds, and molds with heights of 0.5 mm and 1.0 mm were fabricated. Polydimethylsiloxane (PDMS) was used as the container material, and electrodes were fabricated on a printed circuit board (PCB). Considering the electrical double layer property, low surface tension, the dielectric constant and the problem of volatilization, methanol and propylene carbonate were tested as electrolytes. A charge-balanced capacitance circuit was designed as a detection circuit for this sensor and it was fabricated using 0.35 μm CMOS technology. To overcome the surface tension of the PDMS surface, silicone oil was injected in the container to cover the entire inner surface so that the movement of solution in the container became smooth. The linearity of the analog output of ±60° inclination for container dimensions of ϕ4.0 mm × 1.0 mm (diameter × thickness) was less than 6%/F.S. The minimum moving angle and response time were 0.4° and 0.9 s, respectively, when propylene carbonate was used as the electrolyte.

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