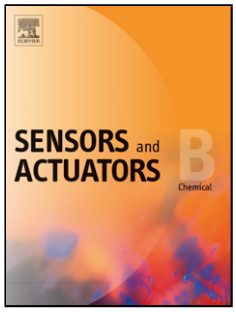

Title: Optimum design of ionization-based gas sensor using vertically aligned multiwalled carbon nanotubes array

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Abstract

In ionization-based gas sensor, the research is very much focus on lowering the voltage breakdown for safe operation. One method to achieve this is by reducing the electrode gap between the sensing element and the top electrode. This approach was explored in the ionization sensor that uses pristine vertically aligned multiwalled carbon nanotubes (MWCNT) array as the sensing element, polyimide film as the spacer and aluminium plate as the top electrode. The electrode gap was varied by growing different thickness of MWCNT array which was determined by the reaction time of the growth. The sensors fabricated with different electrode gaps namely 7, 10, 14 and 17 μm were used to detect the gases such as helium, ammonia and nitrogen. All gases recorded the lowest voltage breakdown in the range of 7 - 30 V in the sensor with the narrowest (7 μm) electrode gap. The significant reduction of 95% of the voltage breakdown is attributed to the narrow gap spacing achieved by controlling the thickness of the MWCNT array grown. Narrow electrode gap and protrusions of nanotips can create a high, non-uniform electric field that produces massive field emission electrons, resulting in ionization of neutral molecules at a very low applied voltage.