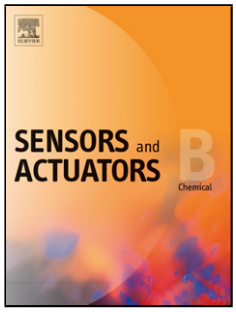

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Design and engineering of ionization gas sensor based on Mn nano-flower sculptured thin film as cathode and a stainless steel ball as anode

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Research Highlights

- Chiral sculptured Mn nano-flower thin films produced and used as cathode in the gas sensor.
- A new shape for the anode electrode (stainless steel ball) is proposed and used in the gas sensor.
- At high gas pressures the breakdown voltage decreased with the anode sizes, while at low pressures the opposite behavior was observed.
- For pd values between 0.025 and 0.2 mbar.cm and for different gases a good gas selectivity was obtained.

Abstract

In this work a field ionization gas sensor based on 3-fold symmetry Mn nano-flower sculptured thin film as cathode and a stainless steel ball (SSB) as anode is used. The breakdown voltage of the system was studied for nitrogen, oxygen, argon, air and carbon mono-oxide gases. Investigations for these gases at different distances between anode and cathode (40, 100 and 200 μm), anode (SSB) diameter sizes of 2, 6 and 10 mm and different gas pressures (0.2 to 1000 mbar) confirmed Paschen's Law. Results for different anode sizes showed that by decreasing the ball size at high pressures the breakdown voltage decreased, while at low pressures the opposite behavior was observed. For pd values (mbar.cm) between 0.025 and 0.2 mbar.cm and for different gases studied in this work a good gas selectivity was obtained. Lower breakdown voltages at medium gas pressures are obtained when comparison is made with the published data for different materials (i.e., CNT, Cu, Au, Ag and ZnO) and designs. The effective secondary emission coefficient of Mn nano-flowers and the ratio of the probability of secondary electron