

Wettability Based Detection of H₂S gas employing Plasmonic Nanostructures Fabricated by Glancing Angle Deposition

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1. Introduction

Hydrogen sulfide is one of the pollutant which has a smell of rotten egg. Sewages, industrial organic garbage and mines are main sources of this gas. It is a very threatening gas in the interest of human health as it quickly deadens the sense of smell and a victim may breathe increasing quantities without noticing until the appearance of severe symptoms. A particular contraction of this gas for long time exposure may cause death. On the other hand, this gas has vital role in physiology and medicine. It is produced in almost all organisms during their metabolism process. It is latest member in the family of gasotransmitter with CO and NO. Thus selective detection of H₂S is essential and crucial in the field of gas sensor and biomarkers. Researchers have explored the field of sensing using resistive, colorimetric, calorimetric, and gas chromatography mass spectroscopy etc. Here we demonstrate a unique technique for H₂S detection based on wetting properties of Ag nanorods (NRs) array, which is found to be quick and selective.

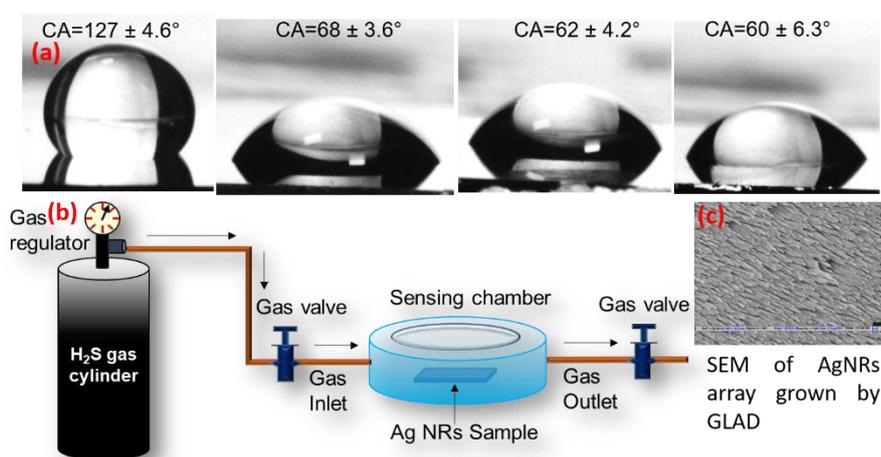


Fig. (a) Variation of contact angle on AgNRs array exposed to 5 ppm of H₂S gas for 0, 1, 3, 5 mins. (b) Schematic of experimental sensing set-up (c) SEM image of AgNRs array fabricated by glancing angle deposition

2. Experimental and Results

For selective sensing of H₂S gas, AgNRs array on glass substrate was fabricated using glancing angle deposition technique. The sensing set up was designed and developed in lab which consists of air tight chamber with valves. Measurement of wettability (contact angle) were carried out at Kruss 25 drop analyzer. Wettability of AgNRs array was found to be highly sensitive towards low concentration of H₂S gas. The change in water contact angle is shown in fig. Silver forms its sulfide (Ag₂S) in presence of H₂S at ambient conditions. Silver sulfide is hydrophilic in nature while pristine AgNRs are hydrophobic (contact angle ~127 °C). It is contact less room temperature, facile and quick detection of H₂S. A drastic change in water contact angle has been observed after exposing the sample to AgNRs. This might be a unique potential tool to detect H₂S gas in various fields e.g. industry, art conservation and health monitoring etc.

References

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