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Self-Assembled MoO_3 Nano Golf Balls: A Trimethylamine Gas Sensor

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Abstract:
Development of trimethylamine (TMA) sensor is of potential interest, since TMA is one of the biomarkers of sea food quality / freshness assessment. In this context, self-assembled MoO_3 golf ball like nanospheres based sensing element was fabricated using spray pyrolysis technique. Investigations were carried-out to understand the growth features by varying the substrate temperature in the interval of 50 K from 523 K to 623 K. An intermediate tetragonal phase molybdenum compound was formed at 523 K and it was completely transformed to MoO_3 with orthorhombic phase at higher deposition temperatures. Surface morphology revealed the nanorod structure for the molybdenum intermediate compound and it was transformed to self-assembled golf ball like nanospheres. The stoichiometry of molybdenum oxide was found to be 3+ and it was confirmed through the stretching mode of terminal oxygen (Mo^{6+} = O) from Raman spectra. Presence of Mo oxidation levels such as 3p, 3d and 4p were revealed by the XPS analysis. Further, room temperature gas sensing signatures were recorded employing customized gas sensing chamber and it was found that all the sensing elements were highly selective and sensitive towards TMA. Golf ball like nanospheres deposited at 623 K showed a maximum response of 335 towards 100 ppm of TMA at room temperature with response and recovery times of 40 and 56 s respectively.

Key words: Trimethyl amine, MoO_3, Spray pyrolysis, Substrate temperature, Phase transition.

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