

QCM Humidity Sensors Based on Organic/Inorganic Nanocomposites of Water Soluble-Conductive Poly(diphenylamine sulfonic acid)

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This paper describes the detection of relative humidity (RH) through measurements of the resonance frequency of the quartz crystal microbalance (QCM) electrodes coated with the novel organic/inorganic hybrid composites of poly (diphenylamine sulfonic acid) (EPSDA), 3-mercaptopropyltrimethoxysilane (MPTMS) and nano- Al_2O_3 powder. EPSDA was synthesized by constant potential electrolysis of diphenylamine sulfonic acid on Pt sheet electrode in HCl media at 0.8 V. The different composite mixtures were simply prepared by ultrasonication of acidic aqueous solution of EPSDA with MPTMS and with or without nano- Al_2O_3 . As prepared sol-gels were drop casted onto the quartz electrodes, and then dried to obtain sensing films. The measured frequency shifts under exposure of different humidity levels showed that the whole sensors studied have high sensitivity, durability and repeatability, almost a full range of linear relative humidity response, fast response/recovery times and low hysteresis. Moreover, they have high selectivity towards humidity over the various polar and non-polar solvent vapors such as alcohol, ketone, ester, chlorinated and non-chlorinated hydrocarbons. These results promise that the EPSDA based organic-inorganic hybrid composites have superior properties for relative humidity measurements.

Keywords: Humidity sensor, quartz crystal microbalance, poly(diphenylamine sulfonic acid), organic/inorganic hybride composites, nanocomposite sensor.

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