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ABSTRACT

Low cost sol-gel spin coating is indeed a popular method for producing thin films but suitable ways of controlling the process for fabrication of a high pH sensitivity TiO_2 sensing membrane that obey Nernstian theoretical response (59.2 mV/pH) are limitedly available and explained. Hence this thesis presents extensive works on studying the condition in sol-gel spin coating so that optimum condition would be identified. Sol-gel TiO_2 is deposited on a conductive ITO coated glass substrate and then spun using spin coater. The solid TiO_2 films produced are later dried and annealed and then measured for their pH response. Characterization of each film for its thickness and roughness was also performed using surface profiler and atomic force microscope. Comparing pH sensing performance of TiO_2 and ZnO thin films, it was determined that TiO_2 is a better sensing membrane for EGFET pH sensor than ZnO. This is because TiO_2 sample shows greater sensitivity and linearity values than ZnO sample. Several parameters in sol-gel spin coating had been studied and the optimum condition was successfully identified. The overall findings in studies of deposition condition is that sol-gel spin TiO_2 thin films ability to sense hydrogen ions can be improved by; fabricating it using a single layer structure as opposed to multiple layer, spun at the speed of 3000 rpm for duration of 75 seconds and annealed at 400 °C for 45 minutes. Based on the data, it was found that thickness of TiO_2 thin films plays vital role in determining capabilities of the film to act as a good hydrogen sensing membrane for EGFET pH sensor. Thinner film has better sensitivity while thicker film shows deteriorating performance in sensing hydrogen ions and suitable TiO_2 film thickness so that it would give high pH sensitivity is between 20 nm to 29 nm. The identified optimum condition is then applied to fabricate an optimized sample and the sample possesses sensitivity of 59.3 mV/pH and linearity of 0.9818. This value of pH sensitivity is high and follows Nernstian theoretical value. Besides that, the reliability and capabilities of the optimized sample to act as a good sensing membrane was further proved from the low drift and hysteresis values measured.

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