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HIGHLY SENSITIVE NANO-MEMBRANE BASED POTENTIOMETRIC THIN-FILM MICROCHIPS RESPONSIVE FOR SOME CATIONS

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Microfabrication, electrochemical evaluation and analytical application of nanoparticles based thin film potentiometric micro-sensors were presented. The elaborated microchips were realized by integration of the nano-materials as sensitive layers on treated surface of thin-film gold square planner substrates. The investigated sensitive elements namely; lead dioxide (β-PbO2) nano-particles, potassium zinc hexacyanoferrate (II) (PZHCF) nano-cubes, titanium dioxide nano-particles were responsive for H^+, Cs^+, Cu^{2+}, respectively. The merits offered by the nano-sensitive materials over the bulk sensitive based membrane include reasonable highly sensitivity (super Nernstian response), fast response time (~20 s), long term stability (4 months) and integration and automation feasibility. A highly sensitive thin-film pH micro-sensor has been fabricated by electrochemical deposition of nano-β-PbO^2 on a gold microelectrode. The realized pH microchip electrode provides excellent linear response to pH values with a super sensitivity (84 mV/pH decade) over the pH 0.25-13 range. A nano-composite comprises PZHCF embedded in multi-walled carbon nano-tubes (CNTs) were used as sensitive layer in fabrication of thin-film Cs^+ micro-sensor. The microchip provides high sensitivity (61±0.5 mV/concentration decade) towards cesium (I) ions covering the concentration range of 1×10^{-1}-1×10^{-5} mol L^{-1}. Plasticized PVC membrane containing titanium dioxide nano-particles was deposited on thin-film microelectrode and tested as Cu^{2+} micro-sensor. The micro-fabricated chip shows good electrochemical properties Cu^{2+} (sensitivity of 23±0.5 mV/concentration decade) covering the range of 10^{-1}-10^{-5} moleL-1. The micro-fabricated chips were successfully applied in the measurements of the corresponding cations in some real samples with high accuracy (97%) and precision (<3%).

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