An All-Solid-State Phosphate Ion-Selective Electrode Using BiPO₄ as a Sensitive Membrane

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In this work, a novel all-solid-state phosphate ion selective electrode (ISE) was constructed using a Pt/Bi/BiPO₄ electrode. The Bi particles were electrodeposited using a function generator and a Schottky diode in bismuth potassium citrate solution. A BiPO₄ sensitive membrane was fabricated by electroplating via performing chronoamperometry on an electrochemical workstation. Under the lens of SEM, both the Bi particles and the BiPO₄ particles formed a homogeneous layer and reached the nanoscale size range. The built electrode exhibited a sound slope of 30.31mV/decade and desirable reproductivity in response to HPO₄²⁻ in the solution. The detection limit of the electrode was measured as 7.718×10^{-7} M, and a linear range for the Na₂HPO₄ solution was exhibited from 10⁻⁶ M to 10⁻¹ M. The average potential fluctuation of the electrode over 1 h was 1.26 mV, and the response time was less than 2 s. The proposed sensor has good selectivity for phosphate and shows satisfactory resistance to common ions such as nitrate, sulphate, acetate and carbonate for use in low-chlorine waters. The BiPO₄ electrode has a proven lifespan of over 90 days, demonstrating the potential for long-term *in situ* testing.

Keywords: ion-selective electrode; phosphate; all-solid-state; BiPO₄; nanoscale

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