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A Fast-Response pH Optode Based on a Fluoroionophore Immobilized to a Mesoporous Silica Thin Film

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This paper describes the preparation and characterization of an optical pH-sensing device using a H^+-responsive fluoroionophore based on boron-dipyrromethene, immobilized to a mesoporous silica thin film. The fluoroionophore substituted with a silane coupling agent (KBH-01-Si) was successfully synthesized, and a mesoporous silica thin film was fabricated by the evaporation-induced-self-assembly (EISA) process. A pH optode was fabricated by attaching KBH-01-Si to the mesoporous silica thin film by covalent bonding *via* a sol-gel grafting method. The resulting pH optode shows single-excitation, dual-emission ratiometric response in aqueous buffer solutions of varying pH values. The sensor response was found to be reversible in the pH range from below 0.8 to 4.2, and showed good repeatability. The response times for a 95% signal change ($t_{95\%}$) were calculated to be 27 ± 2 s (n = 5) for a sample change from pH 4.0 to 1.0, and 23 ± 2 s (n = 5) for reverse change from pH 1.0 to 4.0. These results indicate that the novel pH optode allows for accurate and rapid measurements of pH values.

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