Fabrication of Multi-parameter Chemical Sensor and its Application in the Longqi Hydrothermal Field, Southwest Indian Ocean

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All-solid-state electrodes are potentially suitable as *in situ* sensors for deep-sea environments because of their pressure resistance, rapid response, and ease of integration. Nonetheless, few studies report the application of such electrodes in hydrothermal systems. In this study, we fabricated a multi-parameter chemical sensor (MPCS) incorporating self-made reference, pH, redox (Eh), and H₂S electrodes. During the Chinese Dayang 34I and 49II cruises at the Southwest Indian Ridge (SWIR), the assembled MPCS, equipped with a deep-sea towed camera system, was continuously monitored *in situ* at depths exceeding 2,000 m. The potential anomalies of the Eh, H₂S, and pH electrodes were 49, 98, and 18 mV, respectively, in the Longqi hydrothermal plume area. In the undetected area, the MPCS showed slight anomalies, indicating the presence of an unknown hydrothermal plume at the site. All potential anomalies of the MPCS were consistent with those of commercial sensors (methane, turbidity, and temperature sensors). The test results suggested that the MPCS can sensitively detect changes in chemical quantities caused by hydrothermal fluid, and it provides an effective technique for exploring hydrothermal vents.

Keywords: Chemical sensor, All-solid-state selective ion electrode, Hydrothermal plume, Anomalies, Southwest Indian Ridge

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