# Research on a High-Temperature Humidity and Oxygen Integrated Measuring Instrument Based on the Principle of Limiting Electric Current

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## Abstract

Simultaneous monitoring of oxygen and humidity in high-temperature industrial environments is crucial. Based on the limit current theory derived from the Nernst principle, a theoretical relationship model between oxygen concentration and humidity and limit current is established. Using yttrium-stabilized zirconia (YSZ) solid electrolyte as the core material, a "dual-chamber ceramic chip" structure and its supporting control circuit board were innovatively proposed and prepared to realize the integrated measurement of oxygen concentration and humidity. By building a test environment verification principle, and combining the sensor probe working mechanism and hardware circuit, the supporting software system is developed. The software system integrates the functions of limit current signal acquisition, K-value self-calibration, concentration calculation and host computer display. In order to improve the accuracy and anti-interference ability of the instrument in long-term operation at high temperature, the software innovatively introduces a shift filter algorithm to optimize the weak current noise and humidity dynamic compensation algorithm, and to correct long-term drift in response to environmental changes and a K-value verification algorithm. In this study, an integrated intelligent monitoring instrument for oxygen and humidity suitable for high-temperature environment was successfully developed.

*Innovative Description:* Innovates high-temp O2-humidity measurement via limit current, yttrium-stabilized zirconia dual-chamber chip and optimized algorithms.