Highly selective and stable mixed-potential type gas sensor based on stabilized zirconia and Cd$_2$V$_2$O$_7$ sensing electrode for NH$_3$ detection

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Abstract:
Among engine aftertreatment systems, selective catalytic reduction (SCR) that uses urea as reducing agent has been recognized as the most promising technology to eliminate the NO$_x$ emissions from diesel vehicles. In this system, a urea solution is injected into an exhaust line to react with the NO$_x$ from combustion exhaust. To accurately control the amount of urea injected and to avoid NH$_3$ slips that aggravate air pollution problems, a powerful NH$_3$ gas sensor for on-board diagnosis (OBD) as closed-loop feedback control system must be employed. In this study, we investigate a new Cd$_2$V$_2$O$_7$ composite oxide material as SE for YSZ-based mixed-potential-type sensor, which can be used to detect NH$_3$ at elevated temperatures. The response for the sensor attached with Cd$_2$V$_2$O$_7$–SE to 100 ppm of NH$_3$ was approximately $-67 \text{ mV}$. The response time of the fabricated sensor to 100ppm NH$_3$ was 5s, which exhibited the fast response rate. Moreover, $\Delta V$ almost varied linearly with the logarithm of NH$_3$ concentration in the range of 10–200 ppm, which the sensitivity was $-66 \text{ mV/decade}$. In addition, the detailed sensing characteristics and sensing mechanism of this sensor were identified and discussed.

Key words: NH$_3$ sensor, stabilized zirconia, Cd$_2$V$_2$O$_7$, mixed potential

Fig. 1. Response transients of the sensor utilizing Cd$_2$V$_2$O$_7$–SE toward different concentrations of NH$_3$ at 650°C

References