Characterisation of the p-Electronic Conduction Parameter of NASICON and Na_2CO_3 by Thermoelectric Power Measurement

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From previous observations on the p-electronic conduction parameter ($a_{/}$), it is known that $a_{/}$ is a function of the chemical potential in the surroundings, in contradiction to conventional defect chemical considerations. The thermoelectric power measurement has the inherent advantage over the potentiometric technique that the solid electrolyte is exposed to the same chemical surroundings. With the view of confirming the previous findings on $a_{/}$, the thermoelectric power of the cells

Pt, CO_2, O_2, Au| Na_2CO_3|Au, O_2, CO_2, Pt

Pt, CO_2, O_2, Na_2CO_3 (Au)| NASICON| Na_2CO_3 (Au), O_2, CO_2, Pt

has been determined over the temperature range 698 - 923 K under large interval of sodium activities. The activities have been fixed by using various mixtures of premixed CO_2-O_2-Ar gases in equilibrium with Na_2CO_3. By simulating the obtained experimental data based on the Wagner theory, $a_{/}$ of the materials are obtained. The temperature dependence of logarithm of $a_{/}$ exhibits a linear behaviour. The obtained results show that the materials used in the study behave as a mixed conductor under the condition of measurement, which is in apparent contradiction to many reports on using these materials in conventional CO_2 sensors, stated in the literature. Thus earlier observations on the electronic conduction properties of sodium ion conducting solid electrolytes are confirmed.