

Influence of different oxygen partial pressure on oxide ion diffusion in $\text{La}_{1-x}\text{Sr}_x\text{FeO}_3$

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To find out an effective new way to improve oxide ion conductivity in the mixed conductive oxides, we are interested in influences of different oxygen partial pressures (P_{O_2}) on oxide ion diffusions. Particularly, this study focused on the ion diffusion of $\text{La}_{1-x}\text{Sr}_x\text{FeO}_3$, which is a typical mixed conductive perovskite oxide. We investigated total electrical conductivity (σ_{T}) of the $\text{La}_{1-x}\text{Sr}_x\text{FeO}_3$ ($x=0.2, 0.5$) in the wide P_{O_2} range of 10^{-1} – 10^{-27} atm using a four-probe method. After then, chemical diffusion coefficient D_{chem} in lower- and higher- P_{O_2} ranges were estimated by using an electrical conductivity relaxation method.[1]

With decreasing P_{O_2} from 0.21 atm, the σ_{T} decreased in the ranges of 10^{-1} – 10^{-5} and 10^{-15} – 10^{-20} atm. With further decrease of P_{O_2} , the σ_{T} increased. The result means that the dominating charge carrier is hole (Fe^{4+}) under high P_{O_2} range near air. In the P_{O_2} range around 10^{-20} atm, major valence is Fe^{3+} rather than Fe^{4+} . The D_{chem} in higher P_{O_2} range of 10^{-1} – 10^{-5} atm showed higher values than those in lower P_{O_2} range of 10^{-5} – 10^{-20} atm, indicating that the ion diffusion is faster in higher P_{O_2} range. We suppose that the local structure around the Fe^{4+} is related to the faster ion diffusion.

[1] I. Yasuda and T. Hikita, *J. Electrochem. Soc.* **141** (1994) 1268-1273.