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PREPARATION AND THE ELECTRICAL CONDUCTIVITY OF THE BINARY RARE EARTH METAL FLUORIDE OXIDES

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As new oxide ion conducting ceramics, binary rare earth metal fluoride oxides (BMFO, $LnLn'F_xO_y$, Ln,Ln'; rare earth) were obtained by firing the powdered mixture of rare earth fluoeide (LnF_3) and oxide (Ln'_2O_3) at a temperature of 1100 - 1400 °C in an argon atmosphere. In the solid phase reaction, the anion exchange reaction between LnF_3 and Ln'_2O_3 took place in the temperature range from 200 to 600 °C to give two simple metal fluoride oxides (SMFO) of LnF_xO_y and $Ln'F_xO_y$, and then above 900 °C, both SMFOs began to react with each other to produce BMFO. Two homogeneous phases were identified to be the rhombohedral and the tetragonal. The rhombohedral phase was formed as a stoichiometric compound ($LnLn'_2F_3O_3$) from an equimolar mixture of LnF_3 and Ln'_2O_3. The tetragonal one was found to have a wide homogeneity composition of $Ln_xLn'_{2(1-x)}F_{3x}O_{3(1-x)}$ where x-value was 0.58 - 0.78.

The electrical conductivity of the tetragonal was at least 100 times higher than for the rhombohedral. All of 210 tetragonal $Ln_2Ln'_2F_6O_3$ samples involving reciprocal systems have been investigated. The samples containing Pr or Nd or both gave a high electrical conductivity more than 10^{-2} Scm^{-1} at 650 °C under around 10^{-7}atm oxygen and their crystal structures closely resembled the cubic. The charge carring species of these BMFOs except Ce and Tb-compounds was assumed to be oxide ion. The electrical conductivity of the sintered $Y_2Nd_2F_6O_3$ sample obtained by hot-pressing at 1250 °C under 300 $kgcm^{-2}$ was measured to be 8.0 x 10^{-2} Scm^{-1} at 750 °C, and its oxide ion transport number was calculated to be over 0.93.