Electric conduction mechanism and pressure dependence of conductivity in the (Mg1-xFex)1-dO solid-solution

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(Mg1-xFex)1-dO single crystals were made by a melt-growth method. Electrical conductivity measurements were carried out as functions of temperature and frequency by a the complex impedance method under pressure. Our experimental results show a change in charge transport mechanism in the (Mg1-xFex)1-dO solid solution at high temperature. The temperature of inflection poit of the slope in Arrhenius plots depend grealty on both composition and extrinsic factors of crystals. The low-temperature conduction mechanism in (Mg1-xFex)1-dO solid solution is small polaron. Pressure effect of the electric conductivity was observed and the conductivity increased to 0.5 at log scale of S/m with increasing pressure up to 43.4 GPa. The activation energy was decreased linearly with increasing pressure. Chemical composition and homogenity of specimen rather than pressure greatly influence the electric conductivity. The activation energy for the (Mg0.99Fe0.01)1-dO solid solution is 2.37(4) eV corresponding with a migration enthalpy of O ions via vacancies. It is proposed that possible dominant electrical conduction mechanism in ferropericlase under the lower mantle conditions, at least in the higher temperature region, is anion-conducting super ionic conduction.