ELECTRICAL CONDUCTIVITY AND ELECTROCHEMICAL BEHAVIOR OF LITHIUM-DOPED LANTHANUM MANGANITE

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Li-doped $LaMnO_3$ based on the formula of $Li_xLa_{1-x}MnO_3$ were prepared through the solid state reaction method. The identification of phase and the determination of lattice parameters were examined via powder XRD procedure. The result in Fig. 1 reveals that a solid solution with the formula of $Li_xLa_{1-x}MnO_3$ was formed while x is in the range from 0 to 10 mole%. Beyond 10 mole% of Li addition, a second phase, lithium manganite with spinel structure, was observed.

The conductivity measurement in Fig. 2 shows that the conductivity increases with lithium doping within the solid solution extent. The enhancement in conductivity may be rationalized using the following defect reaction：

$$1/2O_2 + Li_2O + 2MnO_2 \xrightarrow{LaMnO_3} 2Li_{La}^{''} + 4h^{\bullet} + 2Mn_{Mn}^{x} + 6O_o^{x}$$

Thus the concentration of electron holes tends to increase as more Li ions were added into $LaMnO_3$. In addition, the activation energy for conduction was interpreted using the variation of the bond length between Mn and O atoms in the lattice of Li-doped lanthanum manganite. As for the possible electrochemical behavior for lithium insertion or extraction in single phase $Li_xLa_{1-x}MnO_3$, it is investigated in terms of Cyclic Voltammetry and charge-discharge capacity test. In Fig. 3 electrochemical studies display that single phase $Li_xLa_{1-x}MnO_3$ is electrochemically non-active materials for lithium intercalation which is arising from no enough vacancies existing in A-site position for lithium ion to migrate.

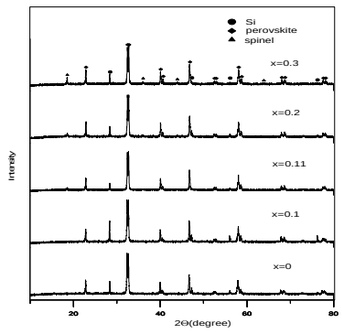

Fig. 1. XRD patterns of powdered $Li_xLa_{1-x}MnO_3$ powder after calcination at 900℃ for 24 hr.

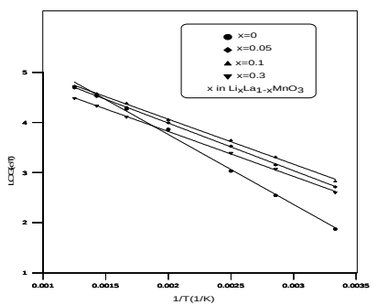

Fig. 2. Conductivity of $Li_xLa_{1-x}MnO_3$ plotted as a function of 1/T

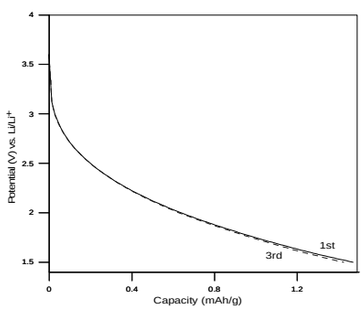

Fig. 3. Discharge profiles of $Li_{0.1}La_{0.9}MnO_3$ cathode at the current density of 0.1 mA/cm^2