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Amorphous Lithium Lanthanum Titanate Electrolyte Thin Films Grown by Pulsed Laser Deposition for Rechargeable Lithium Microbattery

리튬 밧데리를 위해 펄스 레이져 증착법으로 성장시킨 비정질의 리튬 란타늄 타이타네이트 전해질

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In the last few decades, considerable attention has been focused on rechargeable power sources as lithium ion batteries because of their high energy density and good cell performances, in which the choice of fast lithium ion conducting solids as electrolytes is crucial.

Inaguma et al. have reported that perovskite $(Li_{0.5}La_{0.5})TiO_3$(LLTO) in bulk exhibited lithium ion conductivity as high as 10^{-3} Scm^{-1} at room temperature, which was the one of highest lithium ion conductivities. This material has received considerable attention due to its potential use as solid electrolytes in lithium ion batteries. Among all possible anode materials, lithium is the most attractive, since it has a favorable thermodynamic electrode potential with high specific capacity. When lithium is used as an anode material of LLTO solid electrolyte, the electronic conduction which appears due to the reduction of Ti^{4+} to Ti^{3+} in bulk with the intercalation of lithium prevents the use of this material as solid electrolyte. If LLTO was made as an amorphous thin film, electronic conduction produced by an intercalation of lithium may be alleviated by blocking the conduction path of electronic carriers.

In this work, $(Li_{0.5}La_{0.5})TiO_3$ (LLTO) film electrolytes for lithium rechargeable microbattery were prepared onto Pt collector using pulsed laser deposition at various deposition temperatures. As grown 360 nm thick-LLTO films at 400 to 600°C showed an amorphous phase and the ionic conductivity of approximately 2.0 x 10^{-5} Scm^{-1} at room temperature. Lithium metal anode contacted with amorphous LLTO films did not influence on the electronic conductivity of LLTO solid electrolyte differently with a crystalline films. An amorphous LLTO film showed a possibility for application as a solid electrolyte of thin film microbattery.