

Microwave Sintering of $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7}(\text{PO}_4)_3$: A Fast and Efficient Route to Highly Conductive Solid-State Electrolytes

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In this work, microwave sintering is demonstrated as a fast and efficient approach to obtain competitive $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7}(\text{PO}_4)_3$ (LATP) suitable for solid-state batteries. LATP pellets were shaped by combined uniaxial and isostatic pressing at four and five tons, respectively, with a green relative density of 71%. Densification was carried out by between 800 and 1100 °C, revealing a sigmoidal densification curve. A relative density of 91.4% was achieved at 1000 °C with only 10 minutes of sintering. At temperatures above 1050 °C, abnormal grain growth and rutile-TiO₂ formation led to microstructural degradation. LATP electrolytes sintered at 1000 °C exhibited an ionic conductivity of 0.5 mS cm⁻¹ at room temperature and an activation energy of 0.20 eV. Symmetric Li|LATP|Li cells cycled for over 500 h at 0.05 mA cm⁻² showed very low overpotentials (<40 mV). Overall, these results establish microwave sintering as a rapid, energy-efficient, and scalable route for producing high-performance NASICON-type solid-state electrolytes.

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