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“Hot pressing NASICONs and garnet ceramic electrolytes for solid state batteries”

Abstract:

Today, Lithium ion batteries (LIBs) are the rechargeable batteries with the highest specific energy. With up to 250-300 Wh/kg they are the technology of choice for Electrical Vehicles (EV) on the market. EVs presently use LIBs based on transition metal oxide cathodes (with Co, Ni, Mn, Al), graphite anodes, and liquid electrolyte solutions (e.g.
LiPF6 salt in a mixture of ethylene and diethyl carbonate).
Unfortunately, this technology presents numerous safety and environmental risks, due to highly flammable components (e.g ethylene
carbonate) that may erupt into thermal runaways after accidental short circuits. In order to increase the energy density (up to 450-500 Wh/kg), lithium metal can replace graphite as anode but its usefulness is limited by the formation of dendrites, which causes short circuits, and its degradation related to continuous electrochemical reduction of liquid carbonates in case of unstable SEIs. In the last few years, many efforts have been dedicated to develop low cost and efficient solid electrolyte. Nasicons and garnets based solid electrolyte represent a valuable option to build a future solid state battery: unfortunately the
high temperature of sintering (generally > 800 C) is slowing down their development. In this talk a new hot press method to prepare low- temperature NASICONs ($Li_{1.5}Al_{0.5}Ge_{1.5}(PO_4)_3$ and $Li_{1.5}Al_{0.5}Ti_{1.5}(PO_4)_3$) and Garnet solid electrolyte ($Li_7La_3Zr_2O_{12}$ and $Li_5La_3Bi_2O_{12}$) will be presented.