

FROM MATERIALS SYNTHESIS TO LITHIUM METAL BATTERIES

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Abstract

Lithium batteries represent a promising technology for enabling global electrical mobility via electric vehicles (EVs), which can help reduce CO₂ emission from the combustion of gasoline (ICEs). Lithium metal is considered as one of the top alternative anodes for the next-generation of rechargeable batteries owing to its high energy (~4000 mAh/g) compared to the traditional graphite (~370 mAh/g). Indeed, when graphite is replaced by metallic lithium at the negative electrode, it may deliver practically specific energies more than double the values of today's lithium-ion batteries, depending on the cathode chemistry. However, in actual practice, the use of lithium metal as an anode with a flammable liquid electrolyte is limited by the formation of lithium dendrites, which may cause battery short circuits and safety issues. The use of solid electrolyte is able to stop Li-metal dendrites propagation acting as a physical barrier. In this presentation I will report the last findings about the optimization of low cost and safe oxides/phosphates-based solid electrolyte materials synthesis (garnet-type LLZO, NASICON-type LAGP and LATP) and their densification process by using hot-pressing method. Moreover in order to follow Li-metal plating/stripping process in lithium metal batteries a modified coin cell was developed for in-situ X-rays diffractions analytical method.

Curriculum vitae

He was born in 1984 in Reggio Emilia (Italy). He is an italian/canadian researcher. He received his Laurea and Master Degree in Chemistry from the University of Bologna in 2008. Then he moved to Genoa where in 2013 he received his Ph.D. degree in Nanotechnology from Italian Institute of Technology IIT (Liberato Manna's group) by studying the colloidal synthesis of Fe and Cu-based nano materials for energy storage (greigite and cuprite). He moved to Canada in 2014: after two years as postdoctoral fellowship in George Demopoulos's group at McGill University exploring hydrothermal synthesis optimization of olivine LiFePO_4 , he became senior researcher at Center of Excellence of Hydro-Quebec (CEETSE), under the supervision of Prof. Karim Zaghib. Recent research efforts are focused on a) solid electrolyte synthesis, (oxydes and phosphates), b) solid electrolyte densification (hot pressing and tape casting SOFC type), c) electrode/solid electrolyte interface, d) Li-S batteries, e) photo-batteries and f) new in-situ characterization methods. He published 48 peer-reviewed articles, 2 book chapters and he is author of 7 patents. Here the Google Scholar profile link: https://scholar.google.com/citations?user=FHie_4sAAAAJ&hl=it&oi=ao