MATERIALS SCIENCE AND TECHNOLOGY

Ammin/DISAT - Solid state and quasi solid state electrolytes for next generation Li-based batteries

Funded By	Politecnico di Torino DISAT - Progetti
Supervisor	AMICI JULIA GINETTE NICOLE - julia.amici@polito.it
Contact	AMICI JULIA GINETTE NICOLE - julia.amici@polito.it
Context of the research activity	The research will focus on solid state and quasi solid state cells for next generation batteries, based on Li metal anode. Polymerization processes allowing to prepare composite polymers will be indagated with various inorganic fillers, to reach a wide stability window. A thorough characterization of the prepared materials will be carried out through physico-chemical techniques. The prepared materials will then be tested electrochemically in lab-scale cells.
Objectives	Today, Lithium based cells production is a crucial theme in Europe, with ongoing projects for European giga factories. In the meantime, classical Li-ion cells are reaching their theoretical energy densities and the studies carried out to overcome this obstacle are countless. One of the studied solutions consists in using directly metallic Lithium as an anode instead of the most commonly used graphite, thus multiplying by ten the specific capacity. However, metallic lithium is highly reactive and potentially represents a safety concern and for this reason has to be efficiently protected. Many materials are currently under study for this application, mainly trying to decrease or eliminate the liquid electrolyte. To this aim, both polymers and inorganic materials are usually considered, either separately or together. In particular polymer based composite membranes containing inorganic/ceramic nanofillers are of great interest. Such composite electrolytes must present high Li ion conductivity and good interfacial stability against Li metal, but also good compatibility with the cathodic material, particularly at higher potential. In this context the objectives of the PhD will consist in studying various composite systems able to answer the defined pre-requisites, prepare these composite electrolytes (for example through simple polymerization techniques) and perform complete physico-chemical characterizations of the studied samples to assess their principal properties. Successively, electrochemical characterization will be carried out, taking into account the state of the arts evolution of the techniques regarding these new families of materials. Last but not least, lab-scale cells will be assembled to test their performances as well as their intrinsic safety features. The possibility of a period abroad will be envisioned, for example to carry out

	particular characterizations not available at Politecnico di Torino.

Skills and competencies for the development of the activity	The candidate is required to have skills in chemical preparation and characterization of new materials as well as, possibly, experience in electrochemical characterization procedures. In addition, the candidate must demonstrate adaptability in both academic and industrial research and a good knowledge of the English language. Last but not least the candidate must have the capacity to work in a multidisciplinary team and to prioritize the different tasks assigned to meet deadlines.