ADVANCED ENERGY STORAGE DIVISION

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ABOUT THE PROJECT

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By 2050 it is expected that electricity will move from 18 to 50% of the worldwide energy matrix, renewable sources of energy will expand four times from the current installed capacity, but CO2 emissions are expected to be half of today's value. In this scenario it is imperative to build novel solutions for energy storage that are still unavailable today and can cope with the predicted demands. Also, the worldwide increasing of portable and wearable electronic devices encourages researches on low-cost, flexible, light-weight, and environmentally friendly energy storage and supply devices. In order to effectively store and supply energy, advancement of battery and supercapacitor is vital to make them economically more viable for applications from communications to transport. The ability of those devices to effectively and efficiently store and redistribute energy is highly dependent on the engineering of their constructions and chemistry of the electrode surfaces and electrodes/electrolytes interfaces. High surface area, chemically stable electrodes and electrode/electrolyte interface knowledge are crucial for both batteries and supercapacitors. In order to have insights into the operation and to develop new and more efficient materials and electrolytes for devices a comprehensive chemical and structural understanding of the interface phenomena is fundamental.
In this project, we aim to nuclei a Center for Advanced Energy Storage, where we are going to study state-of-the-art batteries and supercapacitors under dynamic conditions by Raman and FTIR spectroscopies and high-intensity synchrotron X-ray. Raman and FTIR will be carried out using optical fibers, coupling cell to spectrometers, allowing us to monitor the reactions during charge and discharge of a device. In situ high resolution and time-resolved X-ray diffraction will be performed in the LNLS line. The in situ techniques will be developed for operando conditions to address fundamental interfacial phenomena that could be linked with multiscale calculations and molecular dynamic simulations. This tailored tool will work in synergy with novel material synthesis based on high surface carbon and fast charge transfer electrodes. The center will also rely on a strong integration from its partners at Brazil and abroad to create a better understanding of the chemistry and engineering for the devices. The Center will properly care about human resource formation, technology transfer, and education and knowledge dissemination under the HUB proposal from LNNano/CNPEM.