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Development of hard carbons using bio-sourced precursors as anode materials for Na-ion batteries

The depletion of fossil energies encourages the use of renewable energies; however, they present a drawback: their intermittent nature. So, it is of utmost importance to find new storage energy technologies in order to profit the most of those natural resources. Li-ion technology, which dominates the actual battery market, operates with rare, expensive and limited resources. This is the reason why researches are focalized on new alternatives such as Na-ion technologies. Na-ion batteries are a promising option because of the similar chemical and electrochemical behavior of both Na and Li ions, in addition Na is far more abundant that its Li counterpart. The big challenge for mastering the Na-ion batteries is the conception of high energy density electrodes. Hard carbons, composed by random oriented graphitic domains, amorphous regions and pores, are interesting materials as Na-ion battery anode; in fact, they possess a specific capacity of around 300 $mAh \cdot g^{-1}$, a low working potential and they can be synthesized from a variety of synthetic and organic precursors. In this context, this project focuses on hard carbon synthesis from bio-sourced precursors such as organic polyphenols, bio-polymers and biomass while controlling their physico-chemical properties (morphology, texture, structure and surface chemistry). Then, their electrochemical performance as Na-ion battery anode will be evaluated with a particular interest on the storage mechanism of the Na ions into these hard carbons. Best performing materials will be synthesized and tested for large scale application in collaboration with the NAIMA partners (CEA – France, NIC – Slovenia, IDHE – The Netherlands and Biokol – Sweden).