Electrode/electrolyte interphase evolution for next generation Li-ion batteries anodes

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Title and affiliations (must fit in this box)

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Abstract (No longer than 250 words. Both the abstract and references must fit in this box. Style is Calibri 12, single line spacing)

Performant electrochemical storage devices appear as one of the solution to face the challenge of energy transition. In this context, lithium-ion batteries are a well-developed technology[1].

This work is focused on increasing the negative electrode's capacity by understanding the degradation mechanism occurring in the material. Graphitic carbon is commonly used as a negative electrode in commercial battery systems because of its stability, electronic conductivity, and its natural abundance. However, its maximum energy density remains too low to meet the requirements of demanding applications such as electric vehicles. Silicon is a promising alternative anode material to increase its capacity up to 3579 mAh/g, ten times higher than the 350 mAh/g of graphite[2].

However, fractures issues occur in the material, due the high volumetric change over cycling. Using nanoparticles has been shown to alleviate the problem[3] but at this size, the formation of an interphase between the electrolyte and the solid (named SEI) becomes predominant. This SEI stability is fundamental to obtain stable performance of silicon electrodes. The coating of the silicon surface by carbon has proved to protect the bare silicon surface and obtain a more stable SEI[4].

The integration of such nanoparticles in Li-ion anodes improves the electrodes' specific capacities. Those particles are synthetized by laser pyrolysis, a one step process. Impedance spectroscopy, a powerful and non-destructive technique, is used to probe the electrode's interfaces. In this paper, using this technique, an improved stability of carbon coated silicon particles will be demonstrated by comparison to pure silicon.

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