Properties of a lithium-doped state of polyaniline as an active material for lithium batteries

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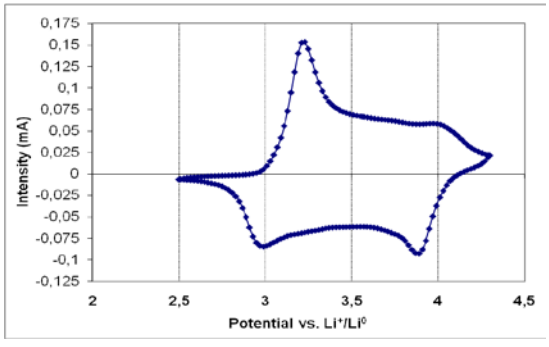
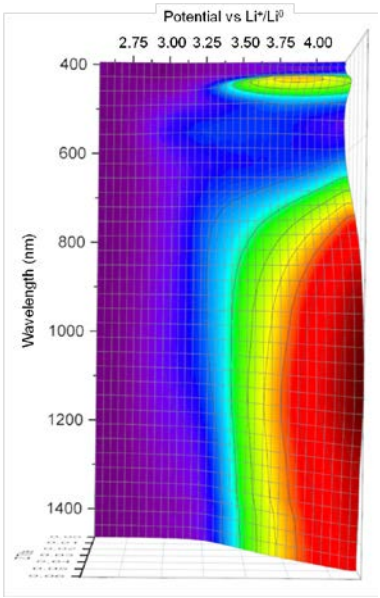
Among the different types of organic compounds that have been tested as active materials for battery electrodes, conducting polymers offer the advantage of a low solubility and a high stability under repeated oxidation and reduction processes. Polyaniline (PANI) is known to be a robust and non expensive positive active material and it even had been incorporated as such in early commercial lithium-ion batteries [1]. Theoretical capacity of PANI in positive electrodes has always been assumed to be 143-145 mAh/g (related to mass of undoped PANI) corresponding to 1 electron per two aniline units in the polymer chain. This is because the second oxidation process in PANI (which would double the value of theoretical capacity) leads to an oxidation state of PANI (pernigraniline) of low stability towards degradation. So far the attempts to reach this second redox process involve the use of polyanions or special counteranions which reduce the practical specific capacity of PANI.

Here we present a chemically modified PANI which shows a higher capacity and a higher stability in a wider potential window than parent PANI. Our approach differs from that of the simple lithium salt doping of PANI, enabling the reversibility of the second redox process in PANI. Electrodes of this new Li-doped PANI with a low amount of carbon additive (5%) present a good rate capability and high reversible specific capacity (220 mAh/g_{PANI}) and energy density values (460 Wh/$kg_{electrode}$).





[1] Lan-Sheng, Y., Zhong-Qiang, S., Ye-Dong, L. (1991). *J. Power Sources*, *34*(2), 141-145; Nakajima, T., Kawagoe, T. 1989. *Synth. Met. 28*(1), 629-638.

[2] Jeon, J. W., Ma, Y., Mike, J. F., Shao, L., Balbuena, P. B., Lutkenhaus, J. L. (2013). *Phys. Chem. Chem. Phys.*, *15*(24), 9654-9662.

[3] European Patent n° EP14305254. P. Jimenez, J. Gaubicher, B. Lestriez, J.P. Bonnet, D. Guyomard.