A new high performance V_2O_5- based cathode for sodium-ion batteries.

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The growing interest in the Na-ion batteries is justified by cost and availability of sodium resources combined with an insertion chemistry close to the lithium one. While α-V_2O_5 was one of the first example of Li intercalation compounds only a few works report Na insertion into that layered host lattice. We recently reported sodium insertion into the so called α-V_2O_5 with a capacity of 120 mAh/g at a low voltage of 1.6V [1]. In this work a new sodium insertion compound is prepared by the chemical oxidation of the γ-LiV_2O_5 using NO_2BF_4 as oxidizing agent. One sodium ion per mole of γ'-V_2O_5 can be reversibly inserted at a remarkably high potential of 3.3V against 1.6V in the usual αV_2O_5. The γ'-V_2O_5 electrode can deliver a reversible and stable capacity of 110mAh/g at C/10 at room temperature (RT). A high capacity of 90 mAh/g is also available at higher 2C rate. An excellent capacity retention is also demonstrated at RT with 105 mAh/g recovered after 100 cycles at C/10. A two phases mechanism involving the γ'-V_2O_5 / γ-NaV_2O_5 system is evidenced from XRD and Raman spectroscopy experiments. The structural features of the fully sodiated γ-NaV_2O_5 phase with an usual expansion of the interlayer spacing (+2Å/compared to γ'-V_2O_5) are solved. These results reveal that the γ'-V_2O_5 constitutes a new competitive cathode material for the reversible intercalation of sodium ions.

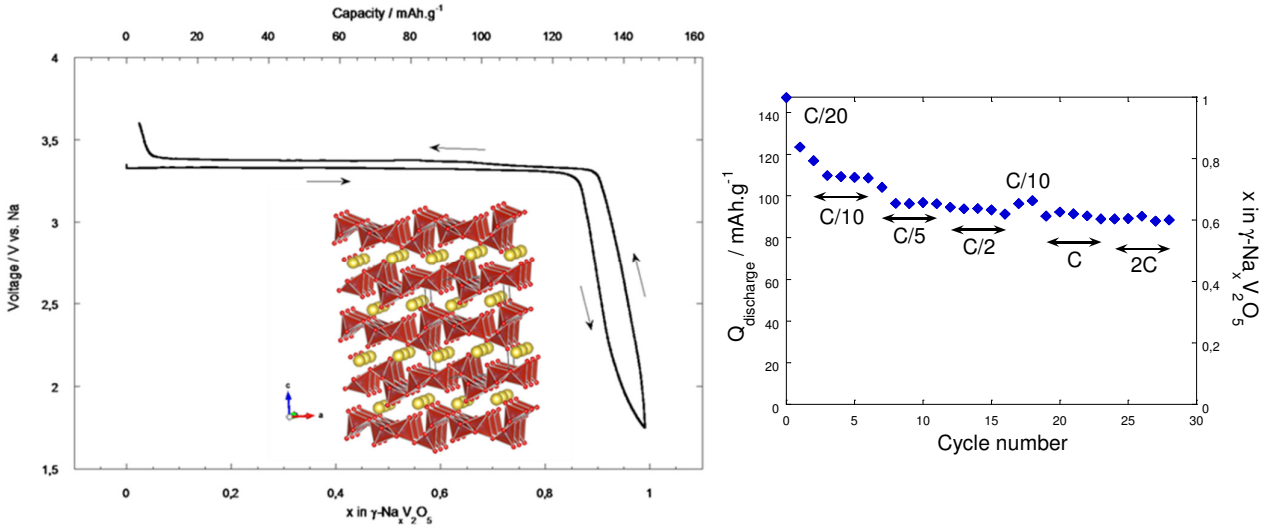

Figure1: Discharge-charge curves of γ'-V_2O_5 in a 1M NaClO4/PC electrolyte at 50°C (C/60). Right: Rate capability behavior at RT.

[1] D. Muller-Bouvet, R. Baddour-Hadjean, M. Tanabe, L.T.N. Huynh, M.L.P. Le, J.P. Pereira-Ramos. Electrochim. Acta.176 (2015) 586.