Hybrid Insertion Electrodes Based on Vanadyl Phosphate or Vanadium Pentoxide and Conducting Organic Polymers.

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Hybrid materials composed of electroactive lamellar inorganic species and conductive polymers provide an opportunity to develop novel active materials for Li cells. The electroactivity of the inorganic components adds up to that of conductive polymers, which in addition provide and electronically conducting matrix [1].

The synthesis approach is based on an "in-situ" oxidative polymerization of the monomer (aniline or pyrrole), between the layers of inorganic species (V_2O_5 or $VOPO_4 \cdot 2H_2O$).

Vanadyl phosphate has been applied as cathode in lithium rechargeable cells, with good insertion kinetics. It is a well known lamellar phase, capable of intercalating different organic molecules. We take advantage of this property to anchor organic conducting polymers, like polyaniline and polypyrrole [2]. We present the synthesis route and characterization of these hybrids, and their preliminary application as cathodes in rechargeable lithium cells.

On the other hand, we prepared PAni/ V_2O_5 by a modified synthesis methodology, in order to evaluate and improve the capacity and cycling characteristics of this hybrid material [3]. We observed a direct relation between stirring conditions and microstructure of the final material. The changes observed in microstructure affected the specific capacity of the hybrid material when analyzed as cathode in lithium batteries. We carried out the corresponding characterization by X-ray powder diffraction, SEM microscopy, BET analysis, FTIR, TGA, elemental and electrochemical analysis. The hybrid material reported here presents higher polyaniline content than those reported before for one monolayer of PAni intercalated into V_2O_5 slabs without increase on interlayer spacing. We obtained hybrids of PAni/V_2O_5 with different stoichchiometry and specific capacities as high as 280Ah/Kg at C/6. We also present the analysis of electrode degradation during battery cycling due possibly to catalytic properties of the V_2O_5.

1) P. Gómez-Romero, *Adv. Mat.*, **13**, 163, (2001)
2) A.K. Cuentas-Gallegos, R. Vijayaraghavan, M. Lira-Cantú, N. Casañ-Pastor, P. Gómez-Romero, *Bol. Soc. Esp. Ceram. Vidrio*, In Press, (2003).
3) A.K. Cuentas-Gallegos, M.R. Palacín, M.T. Colomer, J.R. Jurado, P.Gómez-Romero, *Bol. Soc. Esp. Ceram. Vidrio,* **41**(1), 114-121, (2002).

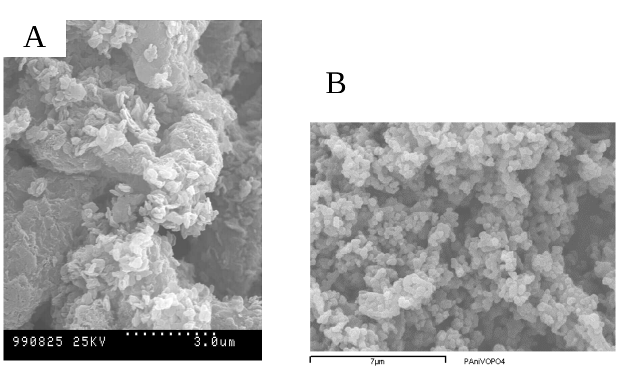

Figure 1.- SEM of hybrids: A)PAni/V_2O_5 3µm scale, B)PAni/$VOPO_4$ 7µm scale.

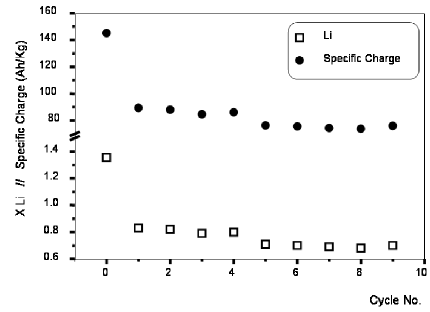

Figure 2.- Electrochemical analysis of PAni/$VOPO_4$ cathodic hybrid. I=10mA/g first 5 cycles and I=20mA/g next 5 cycles.

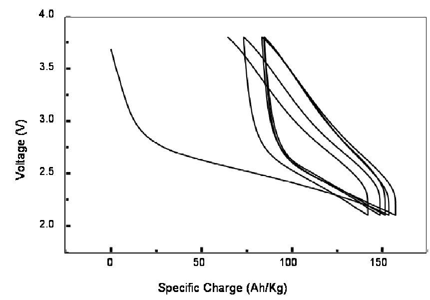

Figure 3.- .- Electrochemical analysis of PPy/$VOPO_4$ cathodic hybrid. I=10mA/g.

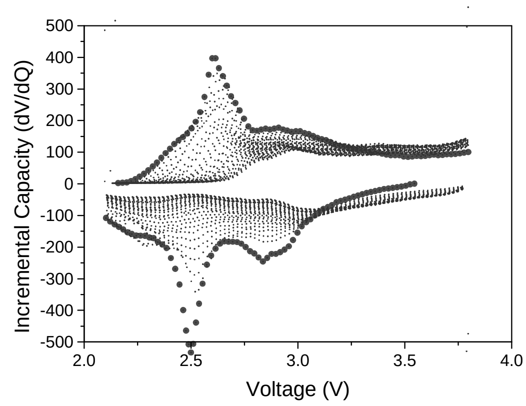

Figure4.- Incremental capacity of PAni/V_2O_5 cathodic hybrid, where we can see the capacity fading.