Electrochemical Redox Processes of Poly(aniline boronic acid)/V_2O_5 Composite

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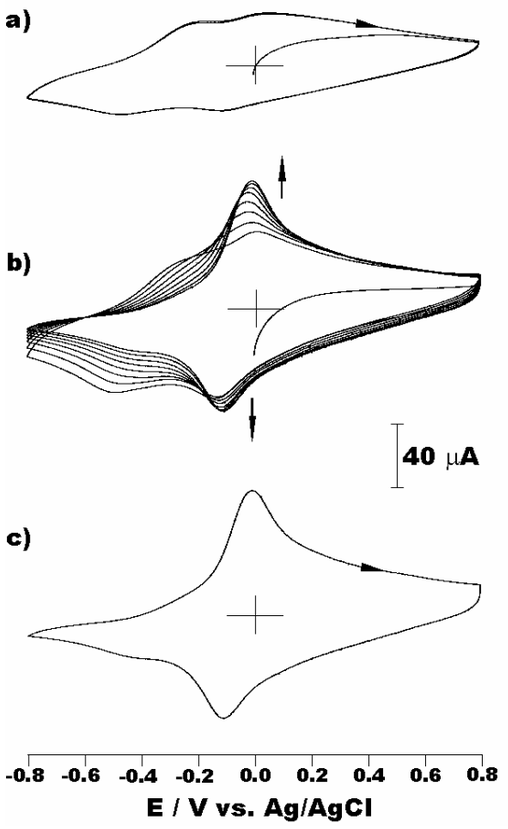
Conducting polymer hybrid materials as organic/inorganic nanocomposites have attracted considerable interests of, but not limited to, the energy storage materials[1-6]. Vanadium oxide is known as intercalating material having high energy density, specific capacity as well as higher chemical oxidation potential[5]. These features give a good performance of cathode material of lithium secondary battery application. The presence of polyaniline (PANI) in the layers of V_2O_5 increases the electronic conductivity and the mobility of Li^+ ions so that the charge capacity of the electrodes can be increased [2,3,6]. A great improvement of the performance can be obtained by the conducting intercalants. Here, to examine the relationship between a function and molecular structure of polyaniline intercalants, poly(aniline boronic acid)(PABA) is employed to produce polyaniline intercalants through in-site molecular conversion[7]. This idea includes the new concept of "in-situ molecular conversion" of intercalants to tune redox and chemical reactivities. As one of part of this research projects, this presentation reports a preparation and an electrochemical redox behavior of PABA/V_2O_5 hybrid material.

PABA/V_2O_5 composite was made by mixing aniline boronic acid with vanadyl tris(isopropoxide). An immediate precipitation happens to PANI/V_2O_5 system after mixing aniline with vanadyl tris(isopropoxide). However, the mixture of 3-aminophenyl boronic acid with vanadyl tris(isopropoxide) produces a homogeneous dark greenish-black solution. After casting this solution onto the electrode, the film of this composite was obtained. The figure shows CVs of a) V_2O_5 alone, b) PABA/ V_2O_5 composite in AN solution containing 0.2M $LiClO_4$. The figure c) shows a steady-state CV after several scanning of b). As can be seen, the charge capacity of PABA/V_2O_5 composite c) has been dramatically increased after several cycles of potential. These results suggest that mixing ABA monomer with V_2O_5 producing PABA/V_2O_5 composite is easy and efficient method to facilitate mobility of Li^+ ions. The influence of several structural/chemical features and measurement conditions will be discussed.



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