Elaboration and characterization of the new material hybrid resulting the mixture pani/ SnNb$_5$Se$_9$

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Abstract

In this work, we realized in studies on the conductors polymers, in general, while insisting on the polyaniline. On the other hand, we presented the SnNb$_5$Se$_9$ compound, that is superconductors with a $T_c=17$ K. From the method of polymerization, we synthesized the PANI / SnNb$_5$Se$_9$ mixture. The structural studies of this new compound are realized by X –Ray diffraction and the infrared spectroscopy. The morphology of the PANI/SnNb$_5$Se$_9$ mixture has been studied by electronic microscopy scanning.

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Keywords: polyaniline, Polymérisation, SnNb$_5$Se$_9$

1. Introduction

The hybrid materials "organic - inorganic" are the object of an immense interest, while permitting to ally some properties of an inorganic material and a polymer at a time. This symbiosis between two worlds of the chemistry too long considered like antagonists can also bring completely new properties and can open a vast field of investigating for the chemist. Inorganic and organic components can then be mixed at the nanometric scale, in virtually any ratio leading to so-called hybrid organic-inorganic nanocomposites [1]. These hybrids are extremely versatile in their composition, processing and optical and mechanical properties [1]. The nature of the interface between the organic and inorganic components has been used recently to classify these hybrids into two different classes [2]. Class I corresponds to all the systems where there are no covalent or ionic-covalent bonds between the organic and inorganic components. In such materials, the various components only exchange interactions such as van der waals forces, hydrogen bondings or electrostatic forces. In contrast, in class II materials, some of the organic and inorganic components are linked through strong chemical bonds (covalent or ino-covalent). Numerous hybrid organic-inorganic materials have been developed in the past few years. The polymers are generally recognized like being of good insulators. Indeed, the classic polymers as the polyethylene and the polystyrene present some conductivity
electronic weak t-squares that vary between $10^{-9}$ and $10^{-18}$ S/cm. The conducting polymers have emerged as new class of they are insulating, the polymers can under some conditions to present remarkable electronic and optic properties [3]. Although system of conjugated double bonds, have the capacity to transport electronic loads: one calls them the conductive polymers. Conductive polyaniline (PANI) has been studied extensively because of its ease of synthesis in aqueous media, its environmental stability and special electrical and other properties. PANI has become a suitable candidate for variety of technological applications [3], such as solar cells, electromagnetic shielding, electrodes for rechargeable batteries, sensors, etc.

The polyaniline is a polymer constituted of units amino and imine that is especially studied and used for his qualities of electronic driver. This polymer can be prepared according to two methods, one chemical [4-5] and the electro-chemical other. The most preferred method for synthesis of PANI composite is to use either HCl or H$_2$SO$_4$ with ammonium peroxydisulfate as an oxidant [3]. The polyaniline emeraldine salt (PANI-ES) has been synthesized by oxidization of the aniline with the ammonium peroxydisulfate in a weak solution of hydrochloric acid [6].

SnNb$_5$Se$_9$ is a coal product generated form inclusion the chains of Nb$_3$Sn compound in polytypic 2H-NbSe$_2$ of structure prismatic trigonal. So achieve the synthesis of a new derivative [7]. The mixture is achieved from 5% where 6% of Nb$_3$Sn purity (99.9%) in NbSe$_2$, the reaction encourages one process of transportation as iodine of which the NbSe$_2$ preparation, in this case one uses the tin in the sparkling state.

2-Experimental

From the method of polymerization, we synthesized the PANI/SnNb$_5$Se$_9$ mixture. Before, in dissolved 5ml of aniline for a double distilled to a hydrochloric with molarities 1M. One out of place in one ball of 250ml, one add directly to 5% of compound of SnNb$_5$Se$_9$. The two reagents one been mixed by the agitation during 1h in a temperature to 4°C. A second solution of ammonium peroxydisulfate, one already prepared, has been added to drip during 30min while keeping the reactional mixture under agitation constant to an initial temperature. The agitation continuation until the mixture turned into strong powdery green brown during 4h. The gross earnings has been recovered by filtration and cleaned by 100 aliquot ml to (50v/v) methanol / water in order to eliminate the oligomerses capable to be present.

3-Result and discuses

3-1 X-ray diffraction

Diffraction pattern of PANI have a broad peak at about $2\theta = 25.92^\circ$, which is a characteristic peak of PANI [8]. Studies on XRD patterns of PANI are scarce in the literature [9]. Figure 1(b) shows XRD patterns of SnNb$_5$Se$_9$. The diffraction pattern of mixture PANI / SnNb$_5$Se$_9$ shows a new pattern resultant. The Figure1 (c), represent the specter of diffraction of (RX) some phase PANI/SnNb$_5$Se$_9$ clearly shows peaks characteristics of diffraction.

After the three specters of diffraction of RX, one gotten the results of stitch parameter by program dicvol04 [10], produces to system orthorhombic again.

The determination of the parameters of stitch of the diagram of powder diffraction by the program that is based on an input file containing the positions of the stripes 20 from the stripes of fitting and by a program indexes that accompanies of an out file while giving the results of stitch parameter and the indications of the (hkl) to duct to the system orthorhombic, of which the parameters:

$$a = 7.013 \text{ Å} \quad b = 3.400 \text{Å} \quad c = 2.504 \text{Å} \quad V = 59.71 \text{Å}^3$$
3-2 The size of the grains

In particular, if one determines the size of the grain of PANI mixture/SnNb5Se9 while using law of Scherrer
\[
d = \frac{\beta \lambda}{\delta \cos \theta}
\]
[11], with: constant varies between; \( \delta = 0.89-1.0 \), width to mid-height and position of the stripe considered, are reported in the table.

Table: Represent the sizes of the grain of the mixture PANI/SnNb5Se9.

<table>
<thead>
<tr>
<th>pick</th>
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<th>centre</th>
<th>with</th>
<th>d(nm)</th>
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</table>

After the results again material, one notices that the size and varied between 4.7 and 44.57 nm.
3-4 Scanning electrons micrograph

The morphology study is realized by scanning electronic micrograph SEM of conducting polyaniline PANI synthesized by chemical oxidative method is shown in figure 4. It is clear, that the shape of surface is constituted by grains of shape short stick of the size 10μm is homogeneous, is conformed by pattern of RX diffraction.

The photon of the figure 5 represents the sample of PANI / SnNb₅Se₉ it is clear and homogeneously distributed. The image SEM presence of spherical SnNb₅Se₉ particles in PANI.
4-Conclusion

The present work rests on two widely-known compound families, the BM$_5$Se$_9$ and the polymers, with what we found the possibility to mix them to construct inorganic and organic hybrid phase again. The addition of a compound inorganic SnNb$_5$Se$_9$ of the family BM$_5$Se$_9$ in the matrix of polyaniline (polymeric) is possible graces to a method of synthesis particular, and permits a new hybrid material. The survey achieved in X diffraction establish that the specter of PANI / SnNb$_5$Se$_9$ is a result of the addition of two compounds, and the survey morphology confirms the structural studies.

References