

**CHAPTER 7****General conclusions and suggestions for further work**

This work deals with the preparation of tin dioxide, tin monoxide and tin-based mixed oxide. Tin dioxide was prepared as a semi amorphous phase, the reaction consisting only of dissolving and stirring tin dichloride dihydrate in water. A gel of tin dioxide could be obtained without having to add any precipitating agent. Concentration of tin in the solution, stirring time and the temperature affect the reaction. Using a low concentration of tin and heating the solution, the time of formation of tin dioxide gel decreases drastically.

The method of preparation of tin monoxide is sensitive to experimental parameters; tin monoxide was obtained by heating a solution of tin dichloride for a short time after which an adequate amount of ammonium hydroxide  $\text{NH}_4\text{OH}$  10% was added to this solution. Tin monoxide is unstable; it easily oxidizes, after prolonged contact with water and absence of heating. The stirring time, temperature and concentration of tin in the solution influence the reaction.

Tin dioxide prepared in this work was obtained as a semi-amorphous phase and it shows a good reactivity for preparation of

mixed oxide based on tin. Vanadium tin oxide solid solution was prepared from tin dioxide and xerogel of vanadium oxide at a relatively low temperature, 500°C.

Preparation of lithium tin oxide was conducted using as starting materials both tin dioxide and tin monoxide. The two oxides showed a good reactivity producing lithium tin oxide when mixed with lithium hydroxide and heated at 600°C. This temperature was much lower than the temperature of preparation of the same material reported in the literature at 1000°C.

It is interesting to remark that lithium hydroxide react spontaneously with both tin dioxide and tin monoxide at room temperature and new phases were formed. From thermal analyses, X-ray diffraction and infrared spectroscopy, the formation of lithium tin oxide followed different processes depending on whether tin dioxide or tin monoxide used.

#### **Suggestion for further works**

1. Attempt of preparation of other mixed oxides ( such as zinc tin oxide, copper tin oxide, etc) at relatively low temperature, by using tin dioxide and tin monoxide, prepared in this work, as starting materials.
2. Study of the electrochemistry behavior of mixed oxides based on tin (vanadium tin oxide, lithium tin oxide) as active electrodes in

lithium rechargeable batteries.

3. A well understanding of the mechanisms involved in the preparation of lithium tin oxide and the characterization of the new phases formed.
4. Exploration of  $\text{LiOH}\cdot\text{H}_2\text{O}\text{-SnO}_2\cdot 1.6\text{H}_2\text{O}$  system; attempt of preparation of new lithium tin oxides.

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