# Processing Parameter Studies on Solution Route Synthesis of Dendrite InSb Powders, Anode Material for Lithium-ion Batteries

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## ABSTRACT

***Intermetallic InSb compound with dendrite morphology was preliminary prepared by redox reaction at room temperature between $InCl_3$, $SbCl_3$ and Zn powder in ethylene glycol solvent. The characterization of the as-received product by XRD technique indicated 48% InSb volume fraction and other impurities. To obtain more intermetallic phase, the effect of processing parameters on the formation of InSb needs to be considered. Therefore, this experiment reports on the consequence of processing parameters such as solvent, reducing agent, reducing agent particle size and reaction temperature to the formation of dendritic crystalline InSb powder. From XRD results, it was observed that the formation of InSb compound depended on the type of solvent and reducing agent whereas no change had been observed by varying reducing agent particle size and reaction temperature. Dendritic morphology, which was verified by TEM patten as InSb phase, was observed by SEM studies in all conditions, using ethylene glycol solvent and zinc reducing agent.***

**Key words:** Electron microscopy, Indium antimonide, Lithium-ion battery, Solution route synthesis

## INTRODUCTION

Intermetallic InSb compound has been introduced as a potential anode material for high energy lithium-ion batteries (Thackeray et al, 1999; Johnson et al., 2000; Vaughey et al., 2000) The InSb electrochemical cell can provide approximately 340 mAh $g^{-1}$ in the first cycle and slowly fades in the subsequent cycles. Developing more crystallinity in InSb compound is one possibility to improve the cell performance. The solution route method which was proposed as an alternative way to produce intermetallic compounds such as $Cu_6Sn_5$, $Cu_2Sb$, and InSb (Sarakonsri et al, 2006) was considered. The InSb powder synthesized by this method was reported to have crystalline dendrite structure. Unfortunately, there were In and Sb metal impurities observed in the product. Processing parameters such as solvent type, reducing agent type, reducing agent particle size and reaction temperature which affect InSb dendrite formation, therefore, were investigated in this experiment (shown in Table 1) in order to receive the most suitable mean to produce high-purity InSb compound. Various viscosity and polarity solvents such as ethylene glycol (EG, JT. Baker, purity 99.0%), dimethyl