Ni-Sn alloys anodes for Li-ion secondary batteries.

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Lithium alloys are very promising anodes materials for rechargeable lithium batteries as they show large capacity compared with the most common carbonaceous materials. The main drawback is the dramatic change in volume of the electrode during the charge-discharge process (lithium dealloying-alloying). The resulting electrode disintegration causes the loss of electric contact between the particles and a consequent very short cycle-life. The electrochemical cycling behaviour can be significantly improved if intermetallic or composite hosts are employed instead of pure metals. A number of Sn_xM_y (i.e. M=Sb, Cu, Fe) intermetallic alloys are currently proposed as host matrices for reversible lithium insertion and extraction in virtue of a process in which lithium alloys tin and a metal matrix is created simoultaneously (1, 2, 3). This matrix, especially if the particles are of nanometric scale, is able to accomodate the changes in volume experienced in the course of the cycling.
In this work we present results obtained with intermetallic compounds based on Ni-Sn alloy. The basical concept is that Ni does not react with lithium but being finely dispersed into the matrix of tin assures a good electronic conductivity to the overall electrode. The intermetallic Ni-Sn compounds are obtained by a reductive precipitation which leads to nanopowders, see fig. 1. The alloying capacity with lithium is confirmed by the cyclic voltammetry shown in fig. 2.
The electrochemical characteristics of the Ni-Sn intermetallic anodes are discussed in this work, also in view of their application in Li-ion batteries.

References

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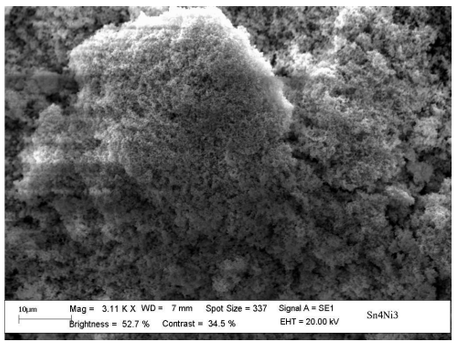

Fig. 1 SEM picture of nanosized Ni-Sn (ca. 75 nm)

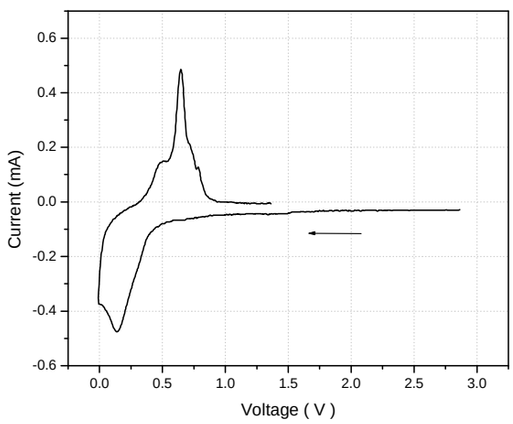

Fig. 2 Cyclic voltammetry of Ni-Sn recorded in 1M $LiClO_4$ EC-DEC, scan rate 50 µV/sec.
Li reference. First cycle.