

Guido Clerici

Industrie Magneti Marelli - Milano

TITANIUM APPLICATIONS IN BATTERIES

Ladies and Gentlemen, I would like to set out the possible applications of titanium in electrochemical power sources. The aim of this survey is to give a comprehensive idea of the possible application of titanium as improver of electrode in batteries, both primary and secondary, that is storage and fuel cells. This survey is based on more than 300 patents since the 1970s. We will shortly see the use of titanium in lead acid storage battery grids, in this there are more than 15 patents, and some few examples of the use in other storage systems.

In lead acid storage batteries we can see why an attempt is made to substitute lead with titanium. There we can see the comparison table, mainly the mechanical properties and the weight. Of course this is more dedicated to some applications where cost is not the main thing to take into account. We can see here one patent and it was applied on a Fiat electric vehicle, on the lead acid battery, with positive grids in titanium and the negatives were in plastic, in polypropylene.

We have seen that the weight saving may be from 30 to 50% on grids and we gain on capacity from 15 to 20%. The advantage is that if the plate lead fails, titanium doesn't dissolve. There is another application with titanium alloys, titanium and 5% tantalum; this is good also for negative grids. We have seen the drawings of the composites, that is very interesting for creep resistance and we have seen the patent with titanium extruded lead wires and the titanium wires in grid casting.

We have seen also the bipolar electrodes by the Allied Corporation. We have done some research in Fiat also for electric vehicle batteries using titanium sheets for a zinc-bromine battery. The titanium sheets were with one side activated by the De Nora systems, with some ruthenium oxides. That battery was developed by Magneti Marelli on government funding in 1972. This zinc-bromine battery is now under development by Action, Toyota, Johnson Controls, Sanyo Laboratories.

A lithium-titanium sulphide secondary battery is under study at Jet Propulsion Lab. in Pasadena.

Last is a redox system using two different valences of titanium: Ti_4 plus electron is Ti_3 in some fuel cells. An interesting application for electrodes is being studied in France by the Agence Nationale pour la Valorisation de la Recherche, that took out an interesting patent on some titanium alloys with niobium, molybdenum, tantalum, zirconium. I have added some bibliographic indications for those who would like to go deeper into details and I am, through friend Ginatta, ready to answer single questions also by letter if you want.

Thank you very much for your attention and I hope this rapid survey will stimulate the research and development of this very interesting field.

Thank you!