# AN ELECTROCHEMICAL STUDY OF NEW OVERSTOICHIOMETRIC $La_{1-x}Ce_xNi_{5.25-y}Mn_y$ HYDROGEN STORAGE ALLOYS

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A growing interest is devoted to the use of intermetallic hydrides as negative electrodes in nickel-metal hydride (NiMH) batteries, because of their ability to replace cadmium in nickel-cadmium batteries which are problematic in term of cost and environment. Almost all of the present-day NiMH batteries use stoichiometric or close to stoichiometric multicomponent $AB_5$-type compounds as negative electrode material. These compounds have proven to exhibit the best compromise between high storage capacity, long cycle life and fast kinetics. It is known that cobalt forms an essential constituent within these alloys, providing a good resistance to corrosion[1,2]. Since Co is considered to be a strategic and costly metal, the Co amount in the alloy has an appreciable impact on the overall battery materials cost. Recently, it has been discovered that cycling stability can also be significantly improved by leaving the stoichiometric $AB_5$ composition, i.e. by making use of over stoichiometric $AB_{5+x}$ compounds[3,4] which turn to be high performance negative materials without making use of precious Co.

In the present study, partial substitution of the B-position atoms in nonstoichiometric $AB_{5.25}$ compounds is investigated through the impact of Ni substitution by Mn element. The investigated composition was in the range $La_{1-x}Ce_xNi_{5.25-y}Mn_y$ with y=0.6; 0.7 and 0.9. We have been able to ensure the electrochemical stability by adjusting for each compound the La/Ce ratio (x value between 0.2 and 0.5). The influence of the chemical composition on the electrochemical behavior is described in terms of specific capacity, cycling behavior (fig. 1), high rate dischargeability and kinetics of hydrogen transport. Good cycling properties combined with excellent kinetics make these new compounds very attractive to be used as negative materials in NiMH batteries.

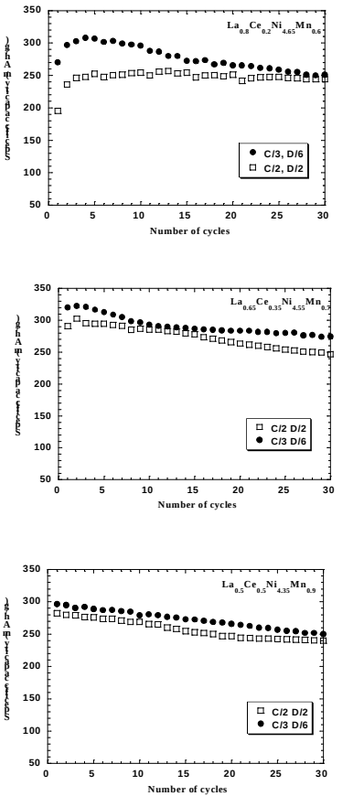


**Fig. 1**: Evolution of the specific capacity vs number of cycles for $La_{1-x}Ce_xNi_{5.25-y}Mn_y$ compounds:
$La_{0.8}Ce_{0.2}Ni_{4.65}Mn_{0.6}$
$La_{0.65}Ce_{0.35}Ni_{4.55}Mn_{0.7}$
$La_{0.5}Ce_{0.5}Ni_{4.35}Mn_{0.9}$

References

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