MSb_XS_Y FAMILIES USED AS NEGATIVE ELECTRODE FOR X^+-ION BATTERIES (X=Li^+, Na^+)

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Li-ion batteries are starting to reach their limits in terms of energy density, cost and abundance, and progress is slower than expected. Thus, researchers are currently re-investigating other alkali metals as Li substitutes, mainly focusing on Na. This system has been considered to be purely academic, and no real applications or prototypes have been developed to investigate its viability or possible commercialization, the only exception being the high temperature Na-S system, which was commercialized in the 1960s.Recently however, the amount of research and number of papers devoted to the development of active materials for Na-ion batteries has increased exponentially, leading the community to consider the commercialization of Na-ion batteries in the near future. To achieve commercialization, suitable anodes and cathodes must be developed and studied in depth as the Na-system is often not analogous to the Li-system.

Recently, we have developed a new type of anode material, $MSnS_2$ (M = Fe, Cu), that is able to cycle in both lithium-ion and lithium- sulphur batteries. By tuning the potential window, we attained specific charges greater than 750 mAh/g and 500 mAh/g for the Li–S and Li–ion system,respectively, after 400 cycles [1].

We decided to apply the same approach to new negative electrode materials Sb-based such as Sb_2S_3 and $CuSbS_2$. As can be seen from the Figure 1, we tested them versus lithium (for Li-ion batteries) and versus sodium (for Na-ion batteries). Without any electrode engineering and with a high loading (ca. 5 mg/cm^2) we manage to cycle both materials in both systems (Li/Na) with a specific charge higher than 700 mAh/g for the Li system and about 600 mAh/g for the Na system.

Advanced electrochemistry results such as CV, different galvanostatic rates and influence of potentiostaticstep will be discussed to assess their performances in both systems.

For the reaction mechanisms, operando X-ray diffraction coupled with XAS measurements and postmortem surface analyses such as XPS and SEMwill be presented and the difference in the reaction mechanisms between the reaction with Li and the reaction of Na will be elucidated.

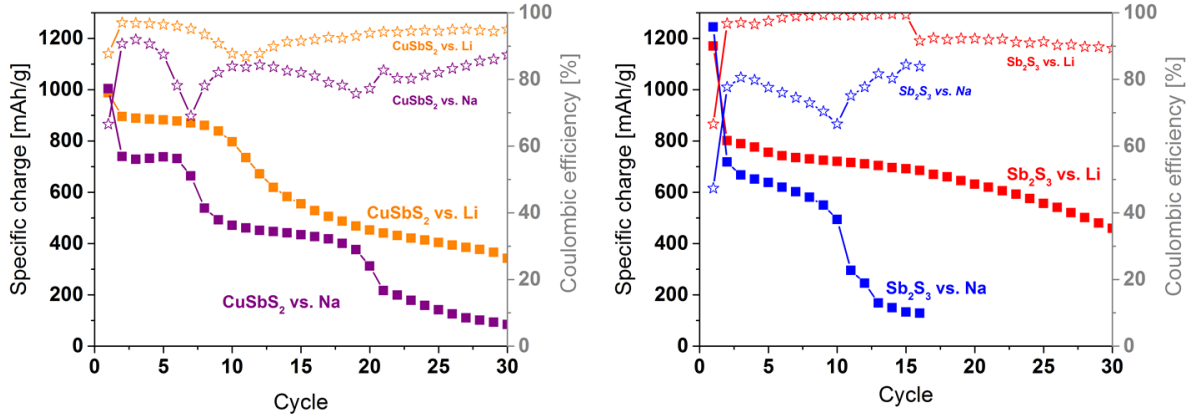

Figure 1.Specific charge obtained from the cycling at C/10 of left) $CuSbS_2$. Right) Sb_2S_3 as negative electrode for Li or Na-ion batteries.

[1] C. Villevieille, P.Novák, J. Electroch. Soc. 162 (2015) A284-A287.

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