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Electrodeposition of porous Cu-Zn alloys showing remarkable low *T* performances in Li-ion natteries

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Zinc is an interesting alloying material for use as anode in Li-ion batteries due to its good theoretical performance, natural abundance, low cost and toxicity. However, its large volume change and, thus, tendency to flake upon lithiation-delithiation makes it unsuitable for practical applications. It is known that intermetallic compounds can better manage the strain associated with Li insertion/de-insertion. This consideration prompted us to investigate porous Cu-Zn alloys, in the range of Zn-rich compositions, made via electrodeposition using the Dynamic Hydrogen Bubble Template (DHBT) method, which has been already applied with success to the preparation of Cu-rich compositions [1].

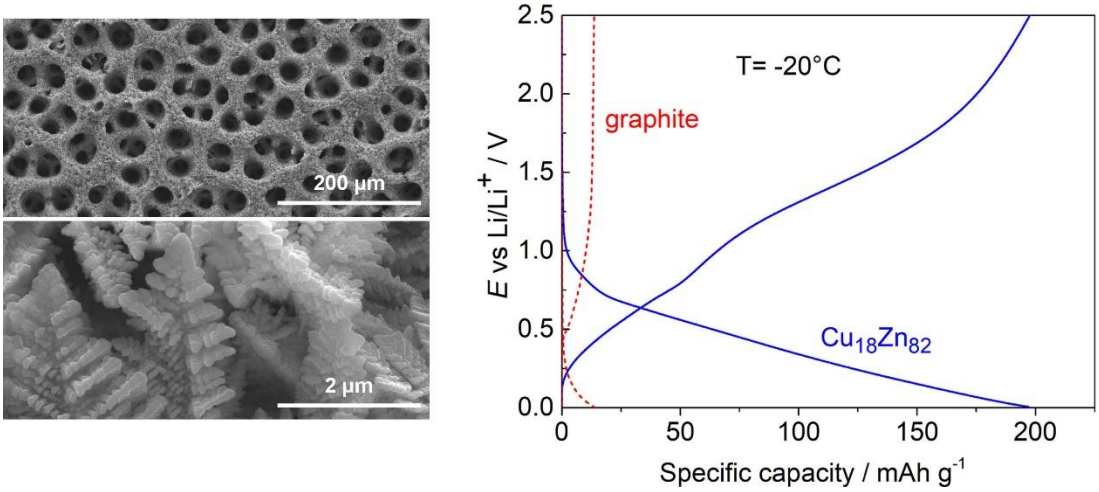

Figure 1: SEM images of a 30 C cm^{-2} $Cu_{18}Zn_{82}$ deposit (left) and voltage profiles upon lithium insertion and extraction at -20 °C (right).

The SEM images (Figure 1, left) show the 3D porous structure of $Cu_{18}Zn_{82}$, warranting easy electrolyte permeation and fast interface charge transfer. Tested as anode for Li batteries at room *T*, the material shows nice performance and mechanical stability, unlike pure Zn. Even more interesting, it retains good performance even at subambient temperatures [2], whereas graphite, i.e., the state of the art material for Li-ion batteries, fails (Figure 1, right) due to unfavorable intercalation thermodynamics. The open issues for material improvement will be indicated and discussed.

[1] L. Mattarozzi, S. Cattarin, N. Comisso, R. Gerbasi, P. Guerriero, M. Musiani, L. Vázquez-Gómez, and E. Verlato, *J. Electrochem. Soc.* **162** (2015) D236-D241.
[2] A. Varzi, L. Mattarozzi, S. Cattarin, P. Guerriero, and S. Passerini, *Adv. Energy Mater.* **8** (2017) 1701706.