ELECTRODEPOSITION AND DEVELOPMENT OF METAL ANODES

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Various metals have been used as battery anodes in electrochemical cells ever since the birth of batteries with Volta's pile and also in the first commercialized primary (Zn/MnO_2, Leclanché 1866) and secondary (Pb/acid, Planté 1859) batteries. The idea and prospects of building a technology based on lithium are much more recent, as it required moving away from aqueous electrolytes. However, the first Li-MoS_2 cells with specific energy two or three times higher than the current Ni/Cd or Pb/acid cells were withdrawn from the market after safety difficulties were experienced with overheating on recharge related to dendrites growth. As an alternative, secondary Li-ion batteries avoiding the use of lithium metal anodes were commercialized by Sony in 1991 [1]. In contrast with Li and Na metal anodes, electrodeposition of Mg and Ca does not seem to be plagued with dendrite formation [2,3,4]. These metals are thus interesting candidates as metal anodes in rechargeable batteries.

Despite issues to develop viable anodes, metal (Li, Na, Mg or Ca) electrodes are commonly used within the battery community as reference and counter-electrodes to investigate the performance of potential electrode materials using the so called half-cell configuration. While this protocol has proved to be reliable in Li based cells, the essential properties for the use of Na, Mg and Ca pseudo reference electrodes remain to be fully assessed. A systematic evaluation of the non-polarizability and stability in the electrolytic environment will be presented for these metal electrodes and the effect of several factors influencing the electrochemical deposition/stripping process will be discussed.

References:

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