The aim to develop batteries based in multivalent metal anodes has recently reemerged as part of the worldwide quest for new energy storage technologies with high energy density. Indeed, figures of merit attainable at the cell level computed using simple models indicate that the theoretical energy densities could easily top the state-of-the-art Li-ion, with costs being potentially much lower.

The viability of a rechargeable technology based on calcium has only been considered recently, after reversible plating/stripping in organic electrolytes was achieved. In the quest for suitable positive electrode materials for multivalent ions, both traditional intercalation hosts, such as TiS_2 or V_2O_5, and alternative materials have been investigated. While V_2O_5 has so far attracted most attention, the interpretation of results is controversial. Electrochemical extraction of calcium in some ternary transition metal ions is feasible but the only compound for which reversible electrochemical calcium insertion/extraction has reliably been achieved is TiS_2, despite the process being complex and non-practically viable as a result of solvent co-intercalation and high cell overpotential.

Overall, there is a long and winding road to follow before reliable proof-of-concept can be achieved and technological prospects evaluated. Development of reliable experimental setups, including reference and counter electrodes, coupled to complementary characterization techniques, as well as computational tools, is mandatory if steady progress is to be achieved.