

Collaborative Learning Exercise Development of a Solid Oxide Fuel Cell Nanomaterials Synthesis SOLUTIONS

1. If you wanted to synthesize nanocrystalline LaMnO₃, give a balanced chemical reaction for the process and develop a flow chart for the synthesis.

In analogy to the synthesis shown in class for ZrO₂, the precursors to be used for the synthesis of LaMnO₃ can be:

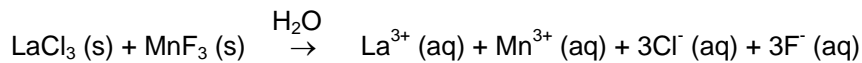
(a) LaCl₃•7H₂O, 99.99% – Cost: ~\$135.00 for 250 g from Alfa Aesar

(b) MnF₃, 98% – Cost: ~\$89.00 for 50 g from Alfa Aesar

Note: It is not possible to buy Manganese (III) chloride, which is what is needed for the LaMnO₃. The only source of Mn³⁺ ions was found to be MnF₃.

The chemical reactions would be:

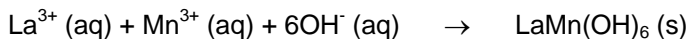
Reaction 1 – Dissolve salts in water.



Reaction 2 – Add ammonia to produce hydroxide ions.



Reaction 3 – Hydroxide ions and metal ions precipitate from solution.



Reaction 4 – Calcination of metal hydroxide powders



The flow chart for the synthesis is the following:

