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Title of the PhD thesis: Effect of microgravity on the 3D printing of lithium-ion batteries

This thesis topic is part of the European Space Agency's strategy to enable astronauts on the space station (ISS) and, in the longer term, those on future long missions and colonies, to be able to manufacture, in situ, spare parts for on-board equipment. Through the MELT Project, a fused wire printer (FFF) was developed by ESTEC (ESA) to print, with PEEK (a polymer with mechanical properties similar to those of metals), mechanical spare parts in microgravity.
If we can print spare parts in microgravity, can we also manufacture, on demand, energy sources such as lithium ion batteries in microgravity?
It is to this question that the PhD student will try to answer. He will rely on the skills and knowledge acquired by the LRCS, a pioneer laboratory in the printing of lithium-ion batteries by FFF.
The impact of gravity on the distribution of charges in printed electrodes and on the quality of the interfaces will be studied. Thus, samples printed on the ground at various inclinations by the MELT project printer will be characterized by means of physico-chemical (microscopy and X-ray tomography) and electrochemical (half-batteries with respect to lithium metal) techniques.
Based on these first results and numerical simulations, optimized formulations of composites will be carried out in order to provide wires that can be printed this time in microgravity on board the ISS. The assembly of a complete lithium-ion battery could also be attempted in these same conditions.

Profile and skills required
Student with good knowledge in the field of batteries, composite polymer formulation or additive manufacturing (FFF). Good level of English required due to the international dimension of the collaboration between LRCS and ESTEC.

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