From research to spinoff: a journey through battery innovation

Francesca Soavi*, Alessandro Brilloni, Federico Poli

Department of Chemistry "Giacomo Ciamician", Alma Mater Studiorum Università di Bologna, Via Selmi 2, 40126 Bologna, Italy

Bettery Srl , Via Pisacane 56, 74016 Massafra, Italy

*presenting author

Lithium-Air (O_2) batteries are considered as one of the next generation batteries, due to their very high specific energy. In these systems, the lightest electrode components are indeed used to deliver theoretically energy 2-3 times higher than that featured by marketable Li-ion batteries. In parallel, Redox Flow Batteries (RFBs) are getting much attention in the energy transition because of their highly flexible design that enables the decoupling of energy and power. However, commercial RFBs still suffer from low energy density. One of the solutions proposed to increase the energy density is the use of semi-solid slurries [1].

We have patented a radically new battery concept, a NEw Semi-Solid flow lithium OXygen battery (NESSOX) that combines the high energy density of the Li/O_2 battery with the flexible and scalable architecture of redox flow batteries. It works with a metal lithium anode and a semi-solid, flowable catholyte, i.e. a suspension of conductive carbon in oxygen-saturated, non-aqueous electrolyte. [2-6]

The challenging prototyping activities that are in progress to upscale NESSOX concept are here presented and discussed.

[1] E. Sánchez-Díez, E. Ventosa, M. Guarnieri, A. Trovò, C. Flox, R. Marcilla, F. Soavi, P. Mazur, E. Aranzabe, R. Ferret, J. Power Sources 481 (2021) 228804
[2] F. Soavi et al. Patent WO2017021840A1
[3] Ruggeri I. et al Electrochim. Acta (2016) 206 291-3
[4] Ruggeri, I. et al . *Carbon*, *130* (2018) 749-757
[5] *F. Poli et al. Applied Energy 248 (2019) 383–389*
[6] *A. Brilloni et al. ACS Appl. Mater. Interfaces 13 (2021) 13872−13882*