NanoLab Talk

Politecnico di Milano, Department of Energy, CeSNEF (Building 19), via Ponzio 34/3, Milan
Seminar Room 1° floor

Monday, 10th February, 2020 – 14:30

In situ spectroscopies and imaging of Zn-air batteries

Benedetto Bozzini

Dipartimento di Energia, Politecnico di Milano

Rational exploitation of the energy produced by renewable sources and electromobility, call for the development of **efficient and reliable energy storage** systems. Batteries are natural candidates for this purpose, and metal-air batteries are expected to gain momentum with respect to Li-ion technologies, because of their potentially higher energy density and sustainability. Among post-Li metal-air systems, **Zn-air batteries** are especially promising for safety, environmental and cost reasons. Disposable devices are already commercially available, but rechargeable systems are still far from the market, because two key challenges still remain open: on the one hand the optimization of **bifunctional catalysts** for the reversible air-cathode, that would increase the round-trip efficiency, and, on the other hand, the minimization of **anode degradation** in both the discharge and charge processes. Even if research is making great efforts in the field, satisfactory grasp of the mechanisms underlying these processes is still lacking. This seminar will focus on an approach to the fundamental understanding of a comprehensive range of open issues of Zn-air batteries, based on **spectroscopic and imaging methods**, with special emphasis on ***in situ* X-ray** and **non-linear optical** techniques. Some recent results will be expounded, regarding: (i) **oxygen catalyst fabrication, operation and degradation**, followed ***in situ* by soft-X ray microspectroscopies** (SXM) in the direct and Fourier spaces ([1] and ref.s therein); (ii) **unstable electrodeposition and dissolution** studied by *in situ* SXM [2] and by **photoelectron microspectroscopy** [3]; (iii) **surface chemistry of Zn anodes** investigated by ***in situ* sum-frequency generation spectroscopy** [4]. The talk will be completed with a brief mention to some aspects of novel energy-efficient and reversible recharge approaches, addressed by *in situ* transient-absorption and near-ambient pressure photoelectron methods [5].

References

[1] B. Bozzini et al., J Phys D. 050201, 51 (2018).
[2] B. Bozzini et al., X-ray Spectrometry 527-535, 48 (2019).
[3] B. Bozzini et al., J Phys Chem C 15996-16007, 112 (2018).
[4] F. Rossi et al., J Electroanal Chem (2019) https://doi.org/10.1016/j.jelechem.2019.113641
[5] B. Bozzini et al., J. Power Sources 226815, 436 (2019)

About the speaker:

Benedetto Bozzini is professor of Applied Physical Chemistry at Politecnico di Milano, his research activity covers a broad area at the intersection of Electrochemical Materials Science and Spectroelectrochemistry, and concerns both developing the electrochemical synthesis of novel materials and electrochemical devices, chiefly for energetic applications (fuel cells, batteries, supercapacitors), and pushing forward our capabilities in achieving a molecular-level understanding of the electrochemical interface *in operando*, chiefly with non-linear and X-ray spectroscopies and microspectroscopies. He published over 265 articles in reviewed journals and gave over 35 invited and keynote lectures at International Congresses, Symposia and Workshops.

For further information please contact: carlo.casari@polimi.it

ERC-2016-CoG No. 724610