Gravure printed Lithium-ion batteries (LiBs): towards large area and high-performance materials

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Printed batteries are small storage devices (< 10 mm3) increasingly involved in our daily life to feed small, portable and wearable electronic devices [1]. To this aim, printed batteries need to be highly customizable to be perfectly integrated to the device they have to feed. Printed batteries are recently industrially produced, but the production is limited to primary, not rechargeable devices, mainly produced by screen printing. Rechargeable printed batteries are the new frontiers of investigation as well as new printing technologies. Among printing technologies, gravure is the only one able to couple high throughput and high printing quality and it is particularly interesting for the production of functional layers, such as electrodes for printed batteries. Gravure printing is industrially widespread, especially in the fields of graphics, packaging and currency; for this reason each result obtained at lab-scale could be potentially easy to scale up at industrial level. Despite its advantages, such technology is few investigated, especially in the field of energy, since obtaining functionality and adequate mass loading is challenging using diluted inks. In the last years we demonstrated the possibility to employ gravure printing in batteries manufacturing, producing anodes and cathodes for Lithium-ion devices (LiBs) [2]. During our study we faced many challenges related to the gravure process, and in particular the one related to the ink formulation, providing a methodology to obtain high printing quality and proper layer functionality [3]. Moreover, keeping into account specific issues related to the materials and the process, we were able to obtain high performance electrode in term of specific capacity, stability, long life cyclability and reproducibility [2, 3]. The obtained results encouraged us to continue our investigation on LiBs, trying new active materials, also having high specific capacity in way to enable the possibility to different batteries application without the limitation of the mass loading. The investigation involved also new binders and solvents, aiming to produce an experimental database with the ink and process characteristics. Using such data in our methodology could provide the ink best recipe as output. In addition, study on large area gravure printed electrodes were carried out form both the point of view of morphology and performances to test the possibility of scaling-up. Here, the most recent results on LiBs are reported and discussed.

References:

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