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3D rGO CATHODES COMBINED WITH BUCKYPAPER INTERLAYER FOR MORE EFFICIENT Li-S BATTERIES

Lithium–sulfur batteries have become an attractive candidate for the new generation of high-performance batteries due to their high theoretical capacity (1675 mA h g−1) and specific energy (~2600 Wh kg−1) overcompensating its low operation potential around 2V [1],[2], . Although the theoretical specific energy values of the Li-S, outperform Li-ion batteries, in practice there are many drawbacks that mean that, nowadays, the energy densities obtained are lower than expected. These issues are due to i) the insulating nature of sulphur, ii) the shuttle effect caused by the solubility of the intermediate polysulfides, iii) the volumetric change taking part in the cathode during cycling and iv) the need to protect the Li anode due to safety considerations [3].

In the present work, we present the development of cathodes for Li-S batteries based on 3D rGO structures to increase the S loading and incorporating a MWCNT buckypaper interlayer to suppress the polysulfide shuttle. The MWCNT interlayer is a low weight sheet consisting of entangled carbon nanotubes that has been manufactured in a continuous mode on a pilot plant designed and developed by Tecnalia.

The buckypaper pilot plant can produce continuous filtered films (MWCNTs only or with selected carrier membranes) with current processing capacities up to 1000 m^2 per year. This plant is part of the e-Platform joint venture that provides industrial access to nano-enabled advanced composites services and products. The facilities are unique in Europe as they enable the scaling of the manufacture of buckypapers from the laboratory scale to a semi-industrial production.

The results of the batteries when the BP interlayer is employed combined with the 3D rGO cathode show specific discharge capacities up to 671 $mAhg^{-1}$ and areal capacities of 2 $mAhcm^{-2}$ at 1C after 200 charge/discharge cycles.

References

[1] W. Kang, N. Deng, J. Ju, Q. Li, D. Wu, X. Ma, et al. A review of recent developments in rechargeable lithium–sulfur batteries. Nanoscale, 8 (2016), pp. 16541-16588

[2] Bresser, D., Passerini, S., & Scrosati, B. (2013). Recent progress and remaining challenges in sulfur-based lithium secondary batteries--a review. Chemical Communications (Cambridge, England), 49(90), 10545–62

[3] Arumugam Manthiram, Yongzhu Fu, Sheng-Heng Chung, Chenxi Zu, and Yu-Sheng Su, Rechargeable Lithium–Sulfur Batteries, Chem. Rev. 114, 23, 11751-11787

Figures

Figure 1: Continuous buckypaper manufactured, 8m length.

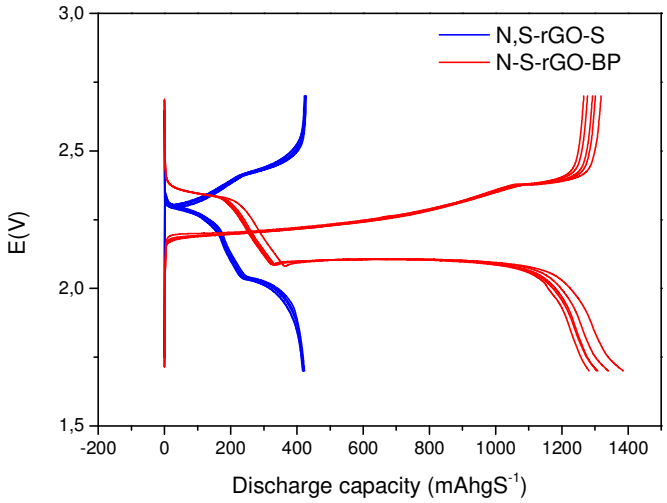

Figure 2: Charge/ Discharge profiles of the first 5 cycles at C/10 of the rGO-S (blue) and rGO-S-Buckypaper cathodes (red)