Inverse Opal Carbons as Cathodes in Lithium/Oxygen Batteries

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Inverse opals are beautiful macroporous materials prepared by template synthesis and presenting a well-defined arrangement of pores of tunable monodisperse size. Thus, they are ideal systems for studying the effect of macropore size in lithium-oxygen electrodes.
In this work, inverse opal carbons were prepared by using poly(styrene-co-methacrylic acid) (PS-MAA) spheres as templates via a resorcinol-formaldehyde sol-gel process and supported on a stainless steel mesh. These were used as cathodes for Li-O_2 batteries using different cell configurations and an ionic liquid electrolyte (LiTFSI inPYR_{14}TFSI). Textural characterisation of inverse opal carbons revealed that superficial composition of the template surface influenced significantly their resulting surface area, pore volume and pore distribution. From the electrochemical characterisation, transverse trends were identified depending on the macropore size of the inverse opal carbon. Smaller macropore size improved reversibility, while higher rate capability was obtained with large macropores. In addition to its use as a model system for understanding textural effects, these electrodes could also provide remarkable capacities of over 3000 mAh/g at 0.1 mA/cm^2.

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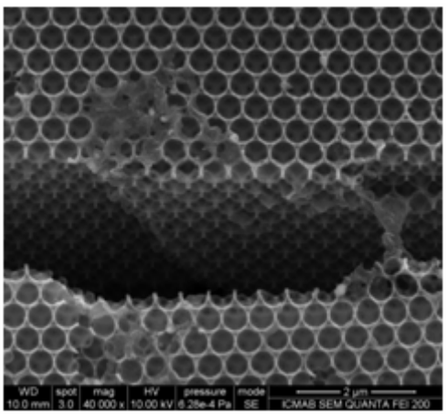

Inverse opal carbon used in this study as SS-supported binderless electrode. The 3-D pore structure is revealed by the crack in the middle of this SEM image.