

## Accepted Manuscript

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PII: S0013-4686(14)02159-8  
DOI: <http://dx.doi.org/doi:10.1016/j.electacta.2014.10.138>  
Reference: EA 23654

To appear in: *Electrochimica Acta*

Received date: 3-9-2014  
Revised date: 27-10-2014  
Accepted date: 27-10-2014

Please cite this article as: Hongjiao Nie, Yining Zhang, Wei Zhou, Jing Li, Baoshan Wu, Tao Liu, Huamin Zhang, Nitrogen-containing mesoporous carbon cathode for lithium-oxygen batteries: The influence of Nitrogen on oxygen reduction reaction, *Electrochimica Acta* <http://dx.doi.org/10.1016/j.electacta.2014.10.138>

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# Nitrogen-containing mesoporous carbon cathode for lithium-oxygen batteries: the influence of Nitrogen on oxygen reduction reaction

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## Graphical abstract

The direct effect of nitrogen content and various nitrogen species on oxygen reduction reaction (ORR) activities in nonaqueous Li-O<sub>2</sub> batteries are systematically investigated. Mesoporous carbon (MC) with various nitrogen species is prepared through heat treatment of N-containing precursor under different temperature. The effect of the heat treatment temperature on the performance of carbon materials in Li-O<sub>2</sub> battery is investigated. The bonding state of nitrogen atoms is found to have a significant effect on the ORR activity. The ORR activity in Li-O<sub>2</sub> battery is proved to be dependent on the quaternary N content while the total N content in the carbon material does not play a crucial role in the ORR process.

## Highlights

- The role of various N in ORR for Li-O<sub>2</sub> battery was investigated.
  - The total N content does not play an important role in the ORR process.
  - The ORR activity in Li-O<sub>2</sub> battery is dependent on the quaternary N content.
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