Researchers Develop Efficient Oxygen Catalysts for Lithium-Oxygen Batteries

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Researchers have fabricated two-dimensional (2D) Mn3O4 nanosheets with dominant crystal planes on graphene (Mn3O4 NS/G) as efficient oxygen catalysts for Li-O2 batteries, achieving ultrahigh capacity and long-term stability.

Lithium-oxygen (Li-O2) battery is one of the most promising batteries due to its high theoretical energy density. However, the poor catalytic performance of its air-cathode impeded its commercialization.

Recently, a joint research group led by Prof. BAO Xinhe and Prof. WU Zhongshuai from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) has fabricated two-dimensional (2D) Mn3O4 nanosheets with dominant crystal planes on graphene (Mn3O4 NS/G) as efficient oxygen catalysts for Li-O2 batteries, achieving ultrahigh capacity and long-term stability.

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Designing oxygen catalysts with well-defined shapes and high-activity crystal facets can effectively regulate the oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) at the three-phase interfaces, but it is still remains challenging.

The researchers indicated that the Mn3O4 NS/G with the (101) facets and enriched oxygen vacancies offered a lower charge overpotential of 0.86 V than that of Mn3O4 nanoparticles on graphene (1.15 V).

Moreover, Mn_3O_4 NS/G cathode exhibited long-term stability over 1,300 hours and ultrahigh specific capacity up to 35,583 mAh/g at 200 mA/g, outperforming most Mn-based oxides for Li-O_2 batteries reported.

Both the experimental and theoretical results proved the lower adsorption energy of Mn_3O_4 (101) for the discharge product Li_2O_2 in comparison with Mn_3O_4 (211), manifesting the easier decomposition of Li_2O_2 during the charging process.

"This work may provide clues for engineering Mn-based materials with defined crystal facet for high-performance Li-O_2 batteries," said Prof. WU.

Read the original article on Chinese Academy of Sciences (CAS).