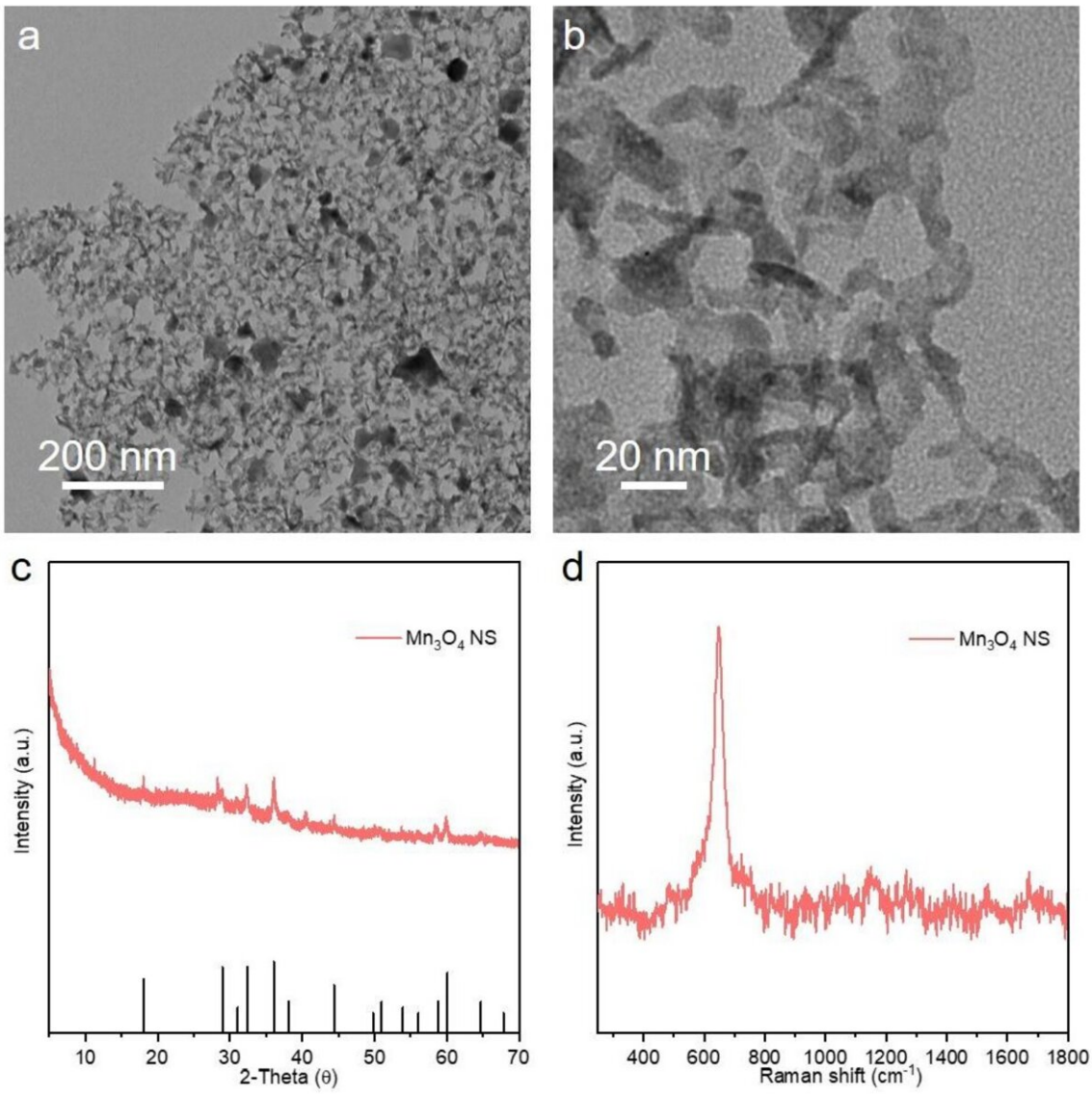
Researchers develop efficient oxygen catalysts for lithium-oxygen batteries

October 17 2022, by Li Yuan



Characterization of Mn_3O_4 NS. (a, b) TEM images, (c) XRD pattern and (d) Raman spectrum of Mn_3O_4 NS. Credit: *ACS Catalysis* (2022). DOI: 10.1021/acscatal.2c02544

Lithium-oxygen (Li-O_2) batteries are promising due to their high theoretical energy density. However, the poor catalytic performance of the technology's 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) fabricated two-dimensional (2D) Mn_3O_4 nanosheets with dominant crystal planes on graphene (Mn_3O_4 NS/G) as efficient oxygen catalysts for Li-O_2 batteries, achieving ultrahigh capacity and long-term stability.

This study was published in *ACS Catalysis*.

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 Mn_3O_4 NS/G with the (101) facets and enriched oxygen vacancies offered a lower charge overpotential of 0.86 V than that of Mn_3O_4 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.

More information: Yuejiao Li et al, Two-Dimensional Mn_3O_4 Nanosheets with Dominant (101) Crystal Planes on Graphene as Efficient Oxygen Catalysts for Ultrahigh Capacity and Long-Life Li–O_2 Batteries, *ACS Catalysis* (2022). DOI: 10.1021/acscatal.2c02544

Provided by Chinese Academy of Sciences