New findings help design highly efficient metal oxide catalyst for ozone removal

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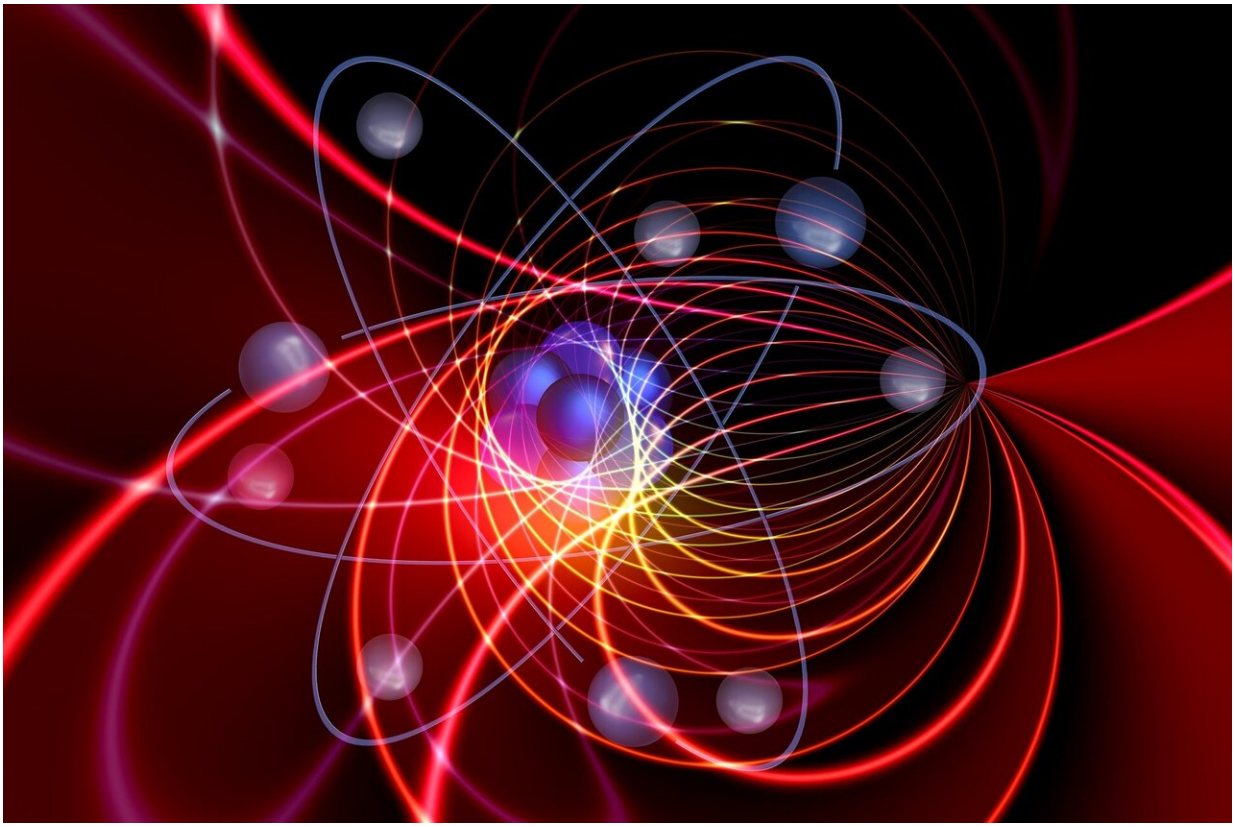

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Atmospheric ozone (O_3) has become one of the major air pollutants. Catalytic decomposition is one efficient and economical technology in O_3 removal, where metal oxides can serve as cost-effective catalysts

substituting for noble metals.

A research team led by Prof. Chen Yunfa from the Institute of Process Engineering (IPE) of the Chinese Academy of Sciences demonstrated the electron generation, compensation and transfer between ZnO and O_3 through tuning crystal defects in ZnO.

The study was published in *Applied Catalysis B: Environmental* on June 6. The findings may help design and synthesize highly efficient metal oxide catalytic materials for air cleaning.

"The efficiency of metal oxides should be improved to the noble metal level, and thus the electron transfer mechanism between metal oxides and O_3 should be investigated," said Prof. Chen.

The researchers demonstrated that crystal defects such as oxygen vacancy, Zn vacancy, and Ga and Li dopants played a vital role in electron transfer.

They found that in ZnO lattice, oxygen vacancy and Ga substitution for Zn could generate electrons, which were then consumed by O_3 to decompose into O_2 and surface adsorbed O_2^{2-}.

Then Zn vacancy and Li substitution for Zn could serve as an electron trapper to grasp electrons from O_2^{2-}, completing the electron cycle and recovering the catalyst. Otherwise, the O_2^{2-} would fill into the oxygen vacancy in ZnO quickly and deactivate the ZnO catalyst.

In their previous studies, Chen's group explored the electron transfer between crystal defects in metal oxide catalysts and O_3, and synthesized kinds of highly efficient O_3 decomposition catalysts (e.g. *Applied Catalysis B: Environmental*, 2019, 241: 578-587; *ACS Applied Nano Materials*, 2020, 3: 597).

"This work is expected to benefit the design and synthesis process of more active O_3 removal material for air cleaning," said Prof. Han Ning from IPE.

More information: Anqi Wang et al, Defect Engineering of ZnO for Electron Transfer in O3 Catalytic Decomposition, *Applied Catalysis B: Environmental* (2020). DOI: 10.1016/j.apcatb.2020.119223

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