New catalysts remove nitrogen oxide pollutants at lower temperatures
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Scientists from Tokyo Metropolitan University have developed a low-temperature catalyst for removing NOx gas from industrial exhaust using ammonia. Composed of bulk "defective" vanadium oxide instead of vanadium oxides supported on titanium oxide as in commercial catalysts, the catalyst works at lower temperatures (100 - 150 degrees Celsius range). Credit: Tokyo Metropolitan University

Conversion rate of nitrogen oxides at different temperatures for conventional, V(V) oxide and V(IV)+V(V) oxide "defective" catalysts. The mixture of V(V) and V(IV) oxides showed a 10-fold improvement in the 100 - 150 degrees Celsius range. Credit: Tokyo Metropolitan University

Now, a team led by Yusuke Inomata and Toru Murayama from Tokyo Metropolitan University have developed a catalyst based on bulk vanadium oxides. Vanadium (V) oxide (V₂O₅) is a common state of vanadium oxide; the team however successfully synthesized a mixture of vanadium (V) and vanadium (IV) oxides, or "defective" vanadium oxide, by heating a precursor to 270 degrees Celsius. They found that this "defective" catalyst had excellent catalytic activity at temperatures down to 100 degrees Celsius; at this temperature, the speed at which NOx is converted to harmless nitrogen was 10 times faster than conventional titania supported vanadium oxide catalysts, showing exceptional performance where conventional catalysts fall short. The improvement was attributed to the presence of V(IV) which creates "Lewis acid" (electron-accepting) sites, promoting the reaction of nitrogen oxide with ammonia to become nitrogen.
Beyond practical application to industrial catalysis, the team hope that the mechanisms they have uncovered serve as a model system for further scientific studies.


Provided by Tokyo Metropolitan University


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