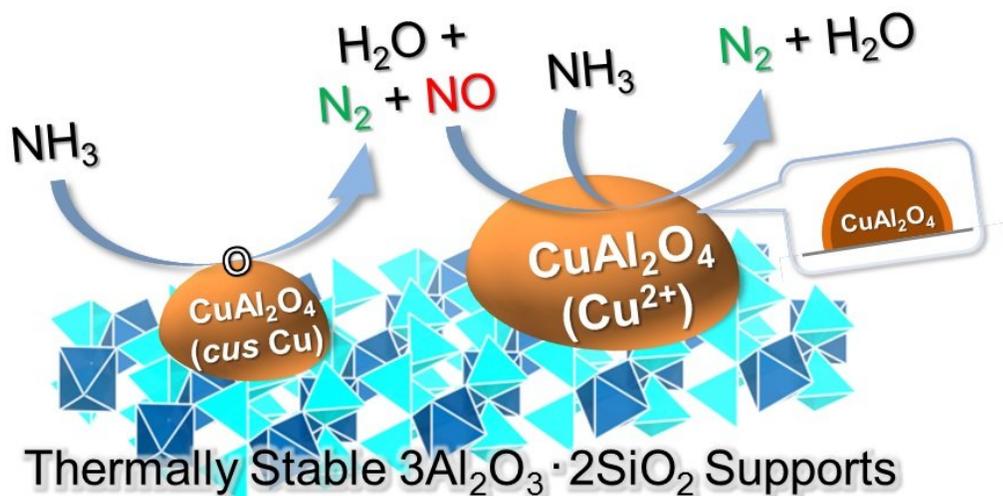


New catalyst turns ammonia into an innovative clean fuel

April 30 2018



$\text{CuO}_x/3\text{A}2\text{S}$ selectively produces N_2 and H_2O from NH_3 through a two-step reaction. Credit: Dr. Satoshi Hinokuma

Taking measures against climate change and converting into societies that use significant amounts of renewable energy for power are two of the most important issues common to developed countries today. One promising technology in those efforts uses hydrogen (H_2) as a renewable energy source. Although it is a primary candidate for clean secondary energy, large amounts of H_2 must be converted into liquid form, which is a difficult process, for easier storage and transportation. Among the

possible forms of liquid H₂, ammonia (NH₃) is a promising carrier because it has high H₂ density, is easily liquefied, and can be produced on a large-scale.

Additionally, NH₃ has been drawing attention recently as a carbon-free alternative fuel. NH₃ is a combustible gas that can be widely used in thermal power generation and industrial furnaces as an alternative to gasoline and light oil. However, it is difficult to burn (high ignition temperature) and generates harmful nitrogen oxides (NO_x) during combustion.

Researchers at the International Research Organization for Advanced Science and Technology (IROAST) in Kumamoto University, Japan, focused on a "catalytic combustion method" to solve the NH₃ fuel problems. This method adds substances that promote or suppress chemical reactions during fuel combustion. Recently, they succeeded in developing a new [catalyst](#) which improves NH₃ combustibility and suppresses the generation of NO_x. The novel catalyst (CuO_x/3A2S) is a mullite-type crystal structure 3Al₂O₃·2SiO₂ (3A2S) carrying copper oxide (CuO_x). When NH₃ was burned with this catalyst, researchers found that it stayed highly active in the selective production of N₂, meaning that it suppressed NO_x formation, and the catalyst itself did not change even at high temperatures. Additionally, they succeeded with *in situ* (*Operando*) observations during the CuO_x/3A2S reaction, and clarified the NH₃ catalytic combustion reaction mechanism.

Since 3A2S is a commercially available material and CuO_x can be produced by a method widely used in industry (wet impregnation method), this [new catalyst](#) can be manufactured easily and at low cost. Its use allows for the decomposition of NH₃ into H₂ with the heat from (low ignition temperature) NH₃ [fuel combustion](#), and the purification of NH₃ through oxidation.

"Our catalyst appears to be a step in the right direction to fight anthropogenic [climate change](#) since it does not emit greenhouse gasses like CO₂ and should improve the sophistication of [renewable energy](#) within our society," said study leader [Dr. Satoshi Hinokuma](#) of IROAST. "We are planning to conduct further research and development under more practical conditions in the future."

This research was posted online in the *Journal of Catalysis* on 26 March 2018.

More information: Satoshi Hinokuma et al, Catalytic ammonia combustion properties and operando characterization of copper oxides supported on aluminum silicates and silicon oxides, *Journal of Catalysis* (2018). [DOI: 10.1016/j.jcat.2018.03.008](https://doi.org/10.1016/j.jcat.2018.03.008)

Provided by Kumamoto University

Citation: New catalyst turns ammonia into an innovative clean fuel (2018, April 30) retrieved 21 September 2024 from <https://phys.org/news/2018-04-catalyst-ammonia-fuel.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--