Exhaust Gas Treatment Catalysts for Ammonia-Fueled Engines

NIKKI - UNIVERSAL

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Company Profile

About Us

Business	Nikki-Universal Co., Ltd. (N-U) is a joint venture company established in 1963 by JGC Corporation, a Japanese corporation, and UOP LLC (UOP), a United States company. N-U's business is mainly to manufacture and sell Refining & Petrochemical catalysts for UOP processes and environmental catalysts.
Established	September 16, 1963
Employees	231 (As of April 1, 2022)
Paid-up Capital	JPY 1,000,000,000

Stockholders

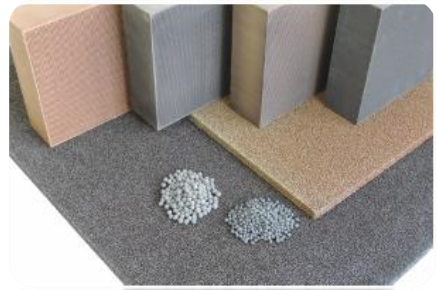
Company Profile

Process Technology and Catalyst

- UOP Process
- UOP Catalyst
- Technical Service
- Chemicals
- UOP Biofuels Technology

Environmental Catalyst

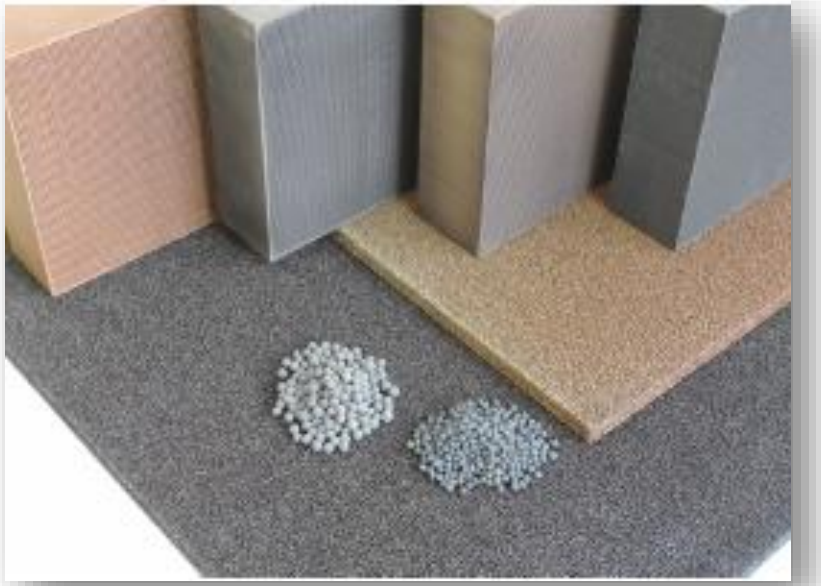
- Exhaust Gas Treating Cat.
- Oxidation, Ozone Destruction Cat.
- Enzyme Filter
- H_2O_2 Decontamination
- Fuel Cell Catalyst

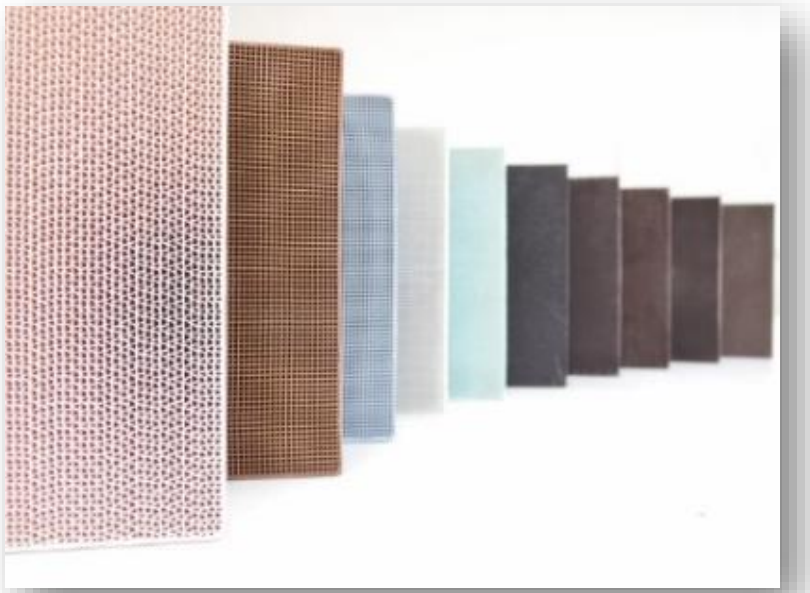


Business Innovation Office

- New Business, New Technology Exploration
- Custom Catalyst

Industrial Environmental Catalysts





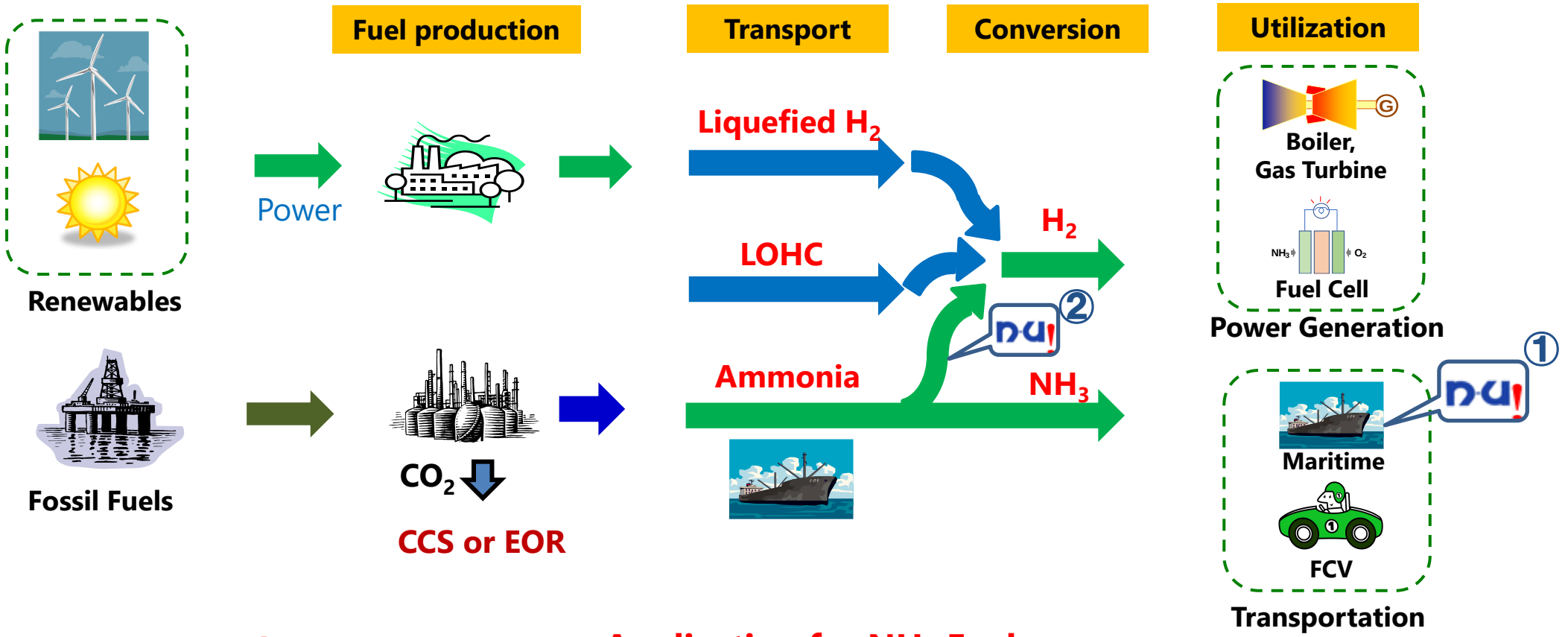
Gas Treatments

- VOC Removal
- Oligomer Removal
- Ozone Destruction
- Ammonia Destruction
- NOx Removal

Fields

Gravure Printing
Automobile Painting
Home Electronics
Chemical Industry
Food Industry
Oven Cleaning
Semi-Conductor
Metal Coating
Enamel Wire

Our Products for Clean Energy and Environment



Current NU's Products

Application for NH_3 Fuel area

① Industrial Environmental Catalysts ⇒ DeNOx, DeN_2O and Slip NH_3 Destruction for Exhaust Gas Treatment

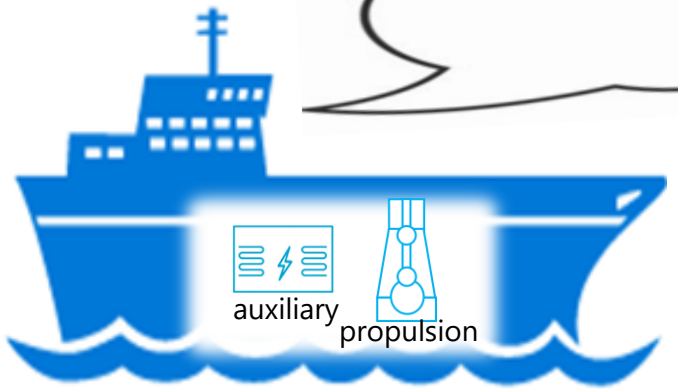
② Ni, Ru Catalysts ⇒ NH_3 Cracking

Needs for Ammonia Combustion Exhaust Gas Treatment

Combustion exhaust gases from ammonia fueled engine will include …

NH_3 : Strong pungent smell, highly toxic to human body
NO_x : Photochemical smog, acid rain, air pollution
N_2O : GHG about 300 times more potent than CO_2, ozone depleting gas

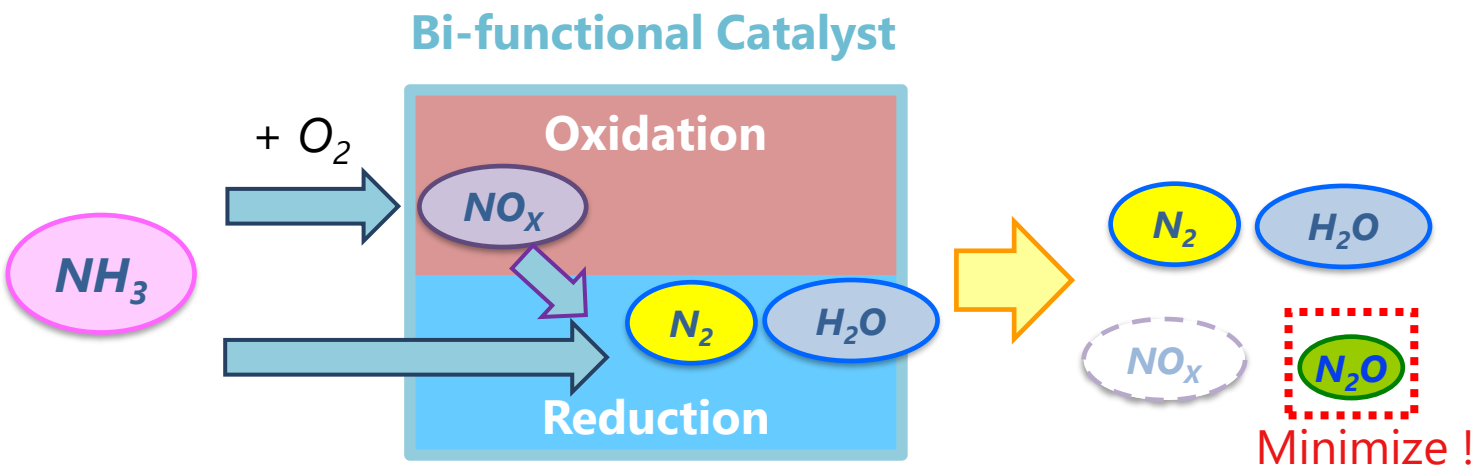
$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O \quad (+ NH_3 + NOx + N_2O)$$



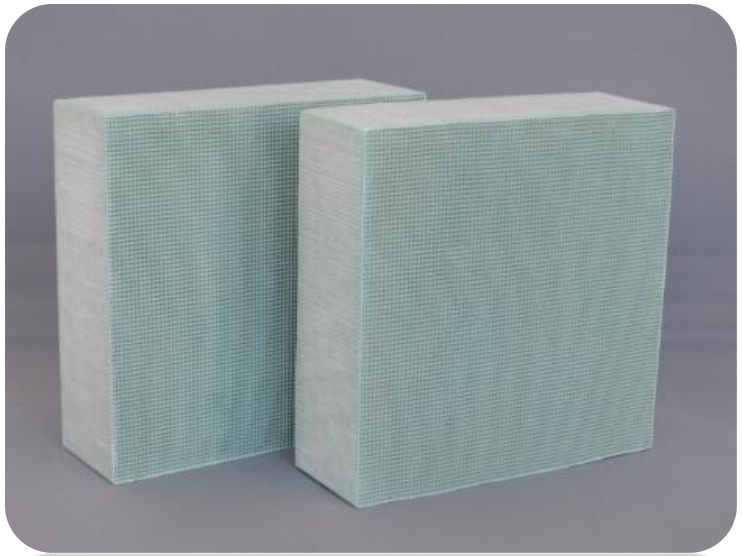
NU offers solutions to eliminate these contaminants!

NH_3 Destruction Catalyst

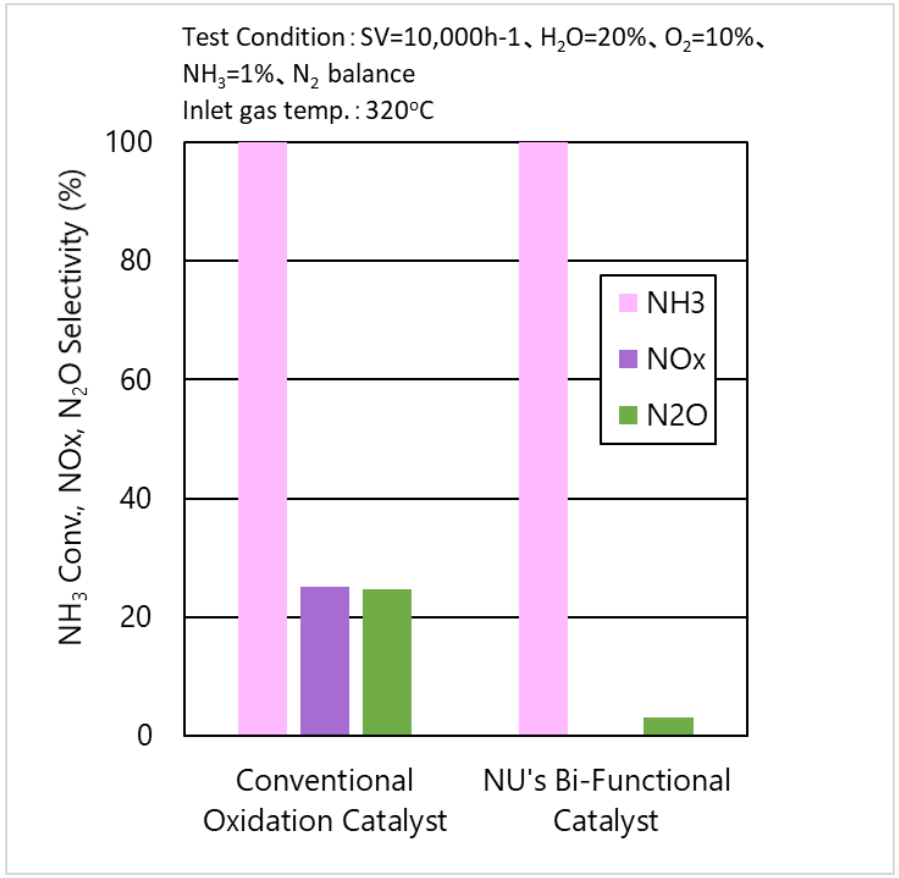
- NH_3 destruction catalyst with oxidative and reductive functions that can decompose NH_3 with minimized production of NOx and N_2O.
- Well proven technology in many cases for NH_3 treatment in industrial exhaust gases.
  - Applications: NH_3 stripper, waste water treatment, etc.
- Applicable to the exhaust gas treatment from ammonia-fueled engines.

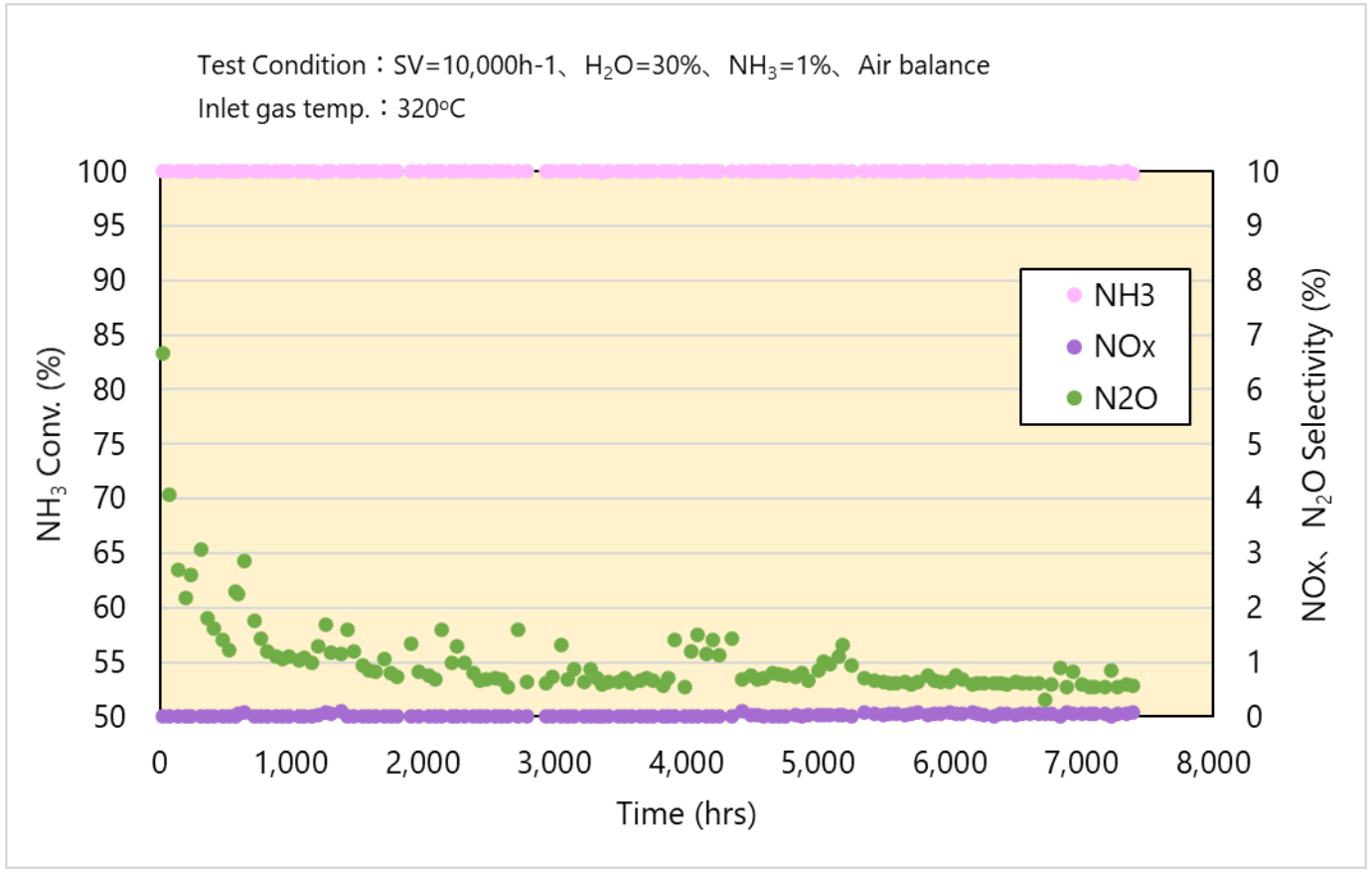


Oxidation : $NH_3 + O_2 \rightarrow NOx + N_2O + H_2O$
Reduction : $NOx + NH_3 + O_2 \rightarrow N_2 + H_2O$
Both reactions occur simultaneously on a single catalyst



NH_3 Destruction Catalyst

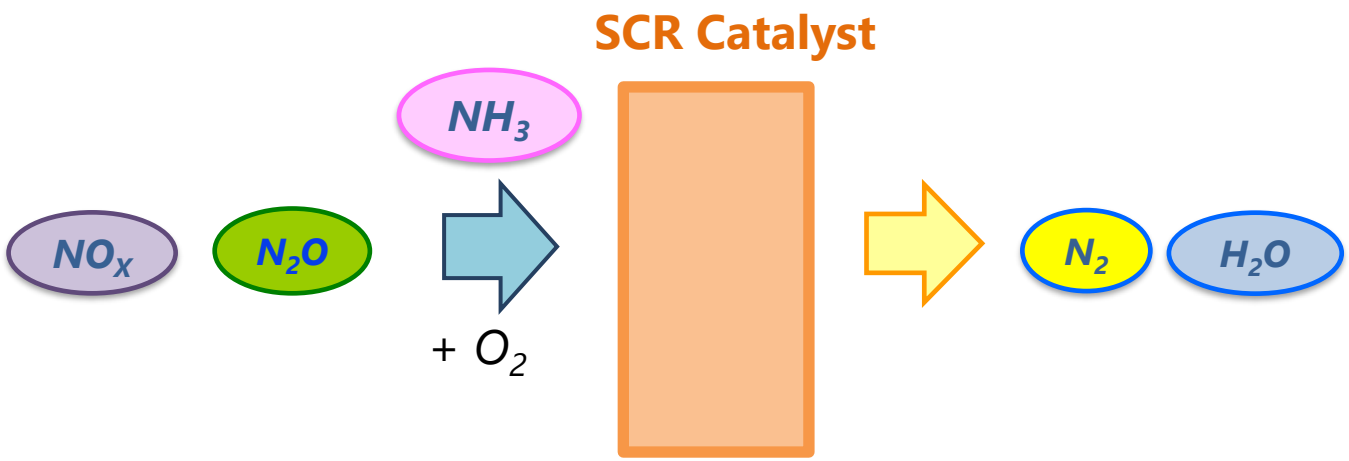




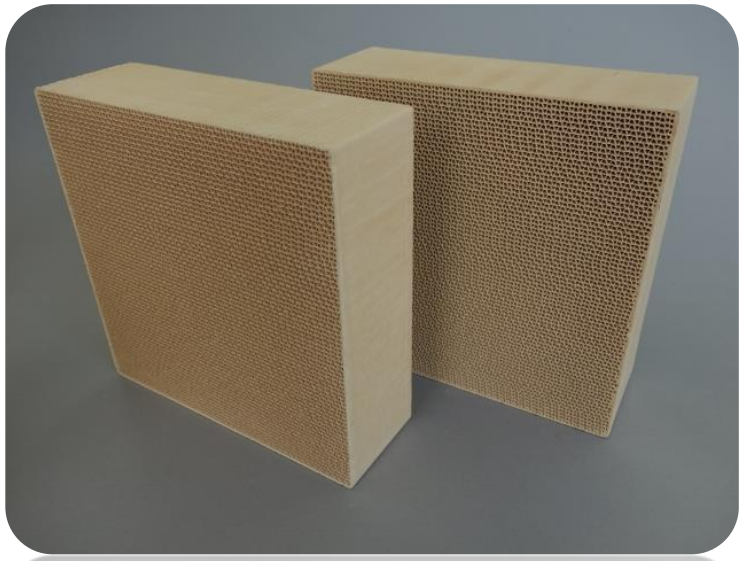
NH_3 destruction catalyst can treat NH_3 with almost no NOx formation and minimized N_2O formation. Long-term stability of NH_3 decomposition performance under high moisture level was confirmed.

DeNOx, DeN_2O Catalysts (SCR)

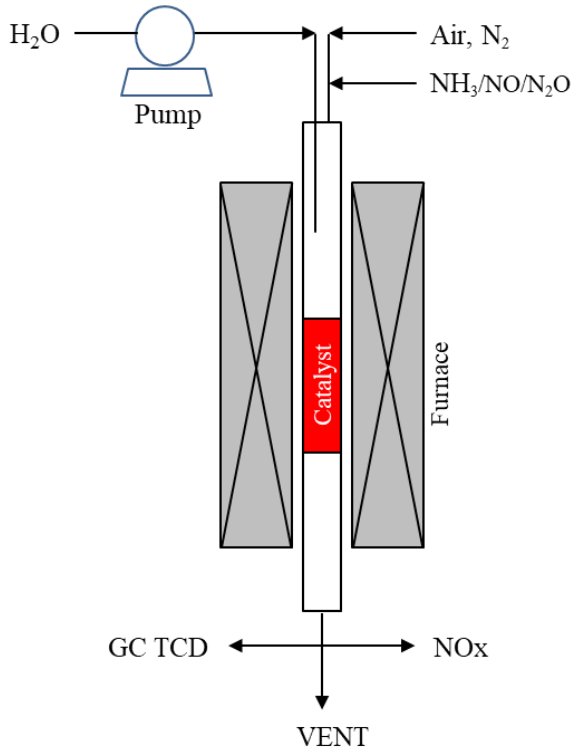
- Conventional DeNOx catalysts (e.g. V-W/TiO_2)using NH_3 as reductant are effective for NOx, but have the following drawbacks.
  - At temperature higher than 400°C, NH_3 decomposition reaction becomes dominant and the deNOx reaction rate decreases.
  - Not effective for N_2O treatment.
- Our SCR catalyst based on zeolite materials can simultaneously treat NOx and N_2O.

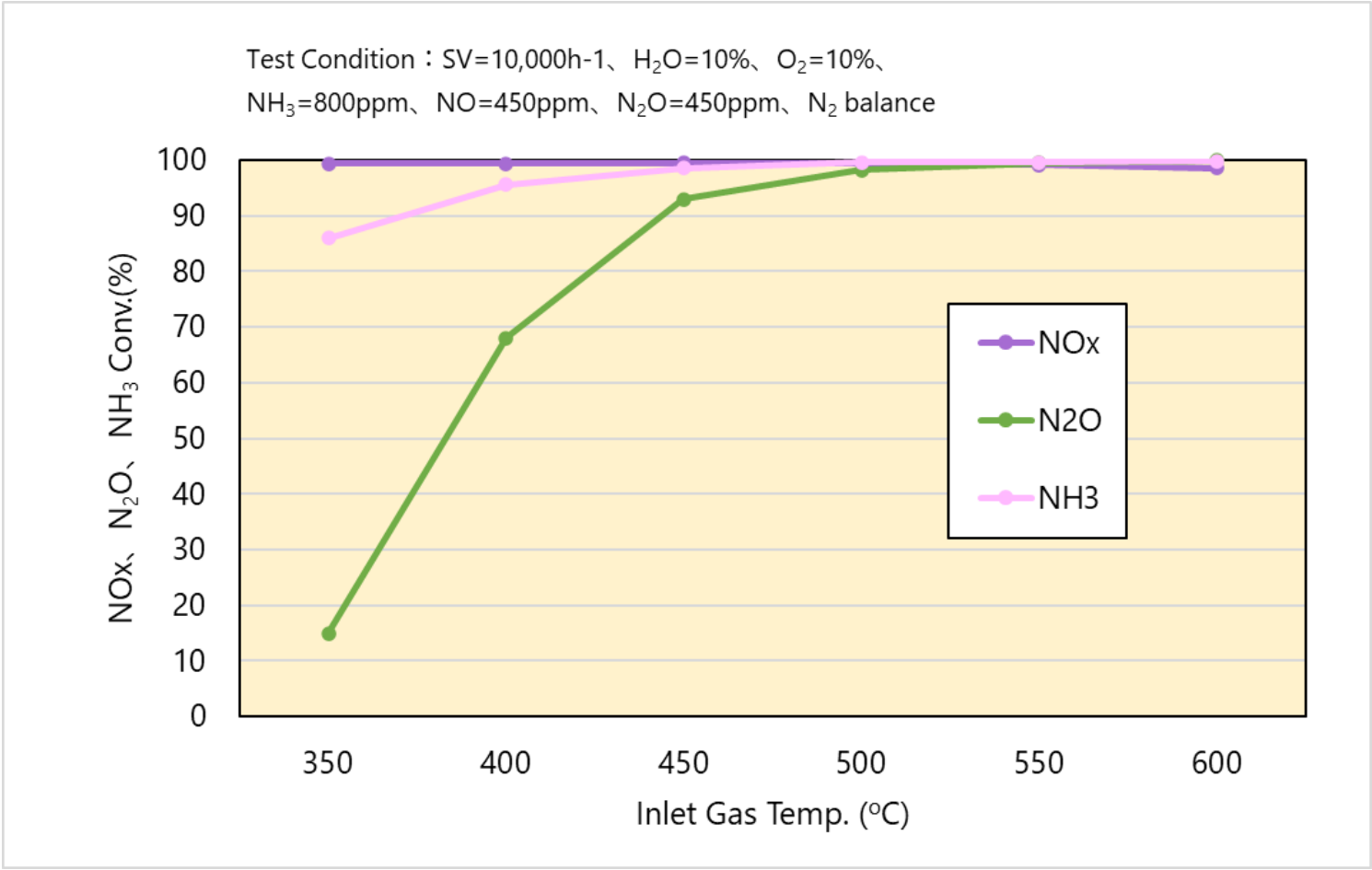


NO SCR : $4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$
N_2O SCR: $2NH_3 + 3N_2O \rightarrow 4N_2 + 3H_2O$
Direct N_2O Decomposition : $2N_2O \rightarrow 2N_2 + O_2$



DeNOx, DeN$_2$O Catalysts





High DeN$_2$O activity as well as DeNOx activity was confirmed above 450°C

Summary

- NU has long experience in NH_3, NOx, N_2O gas treatment!
- NU offers exhaust treatment catalysts for the safe use of clean ammonia fuel!

Ammonia Destruction Catalyst

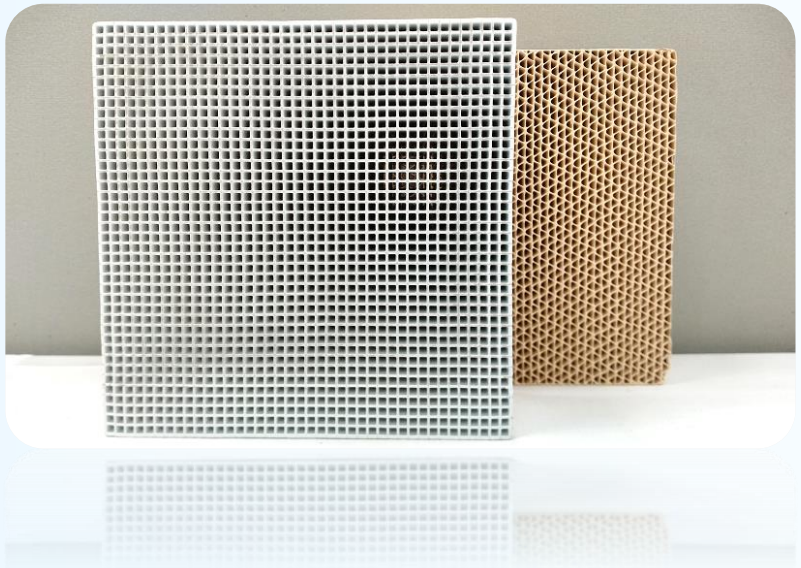
- High NH_3 decomposition activity and NOx suppression
- Development continues to further reduce N_2O formation.

DeNOx, DeN_2O Catalysts

- Simultaneous removal of NOx and N_2O is possible

N_2O Direct Decomposition Catalyst

- Working to develop a catalyst to remove N_2O directly at low temperature without reductant of NH_3 injection.



By utilizing these catalysts, we are working with you to establish a system that meets NH_3, NOx, and N_2O emission requirements!

Thank you!

https://www.n-u.co.jp/en/

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