

Research Highlights

[Vol. 60]

New Solid Materials Enable Broader Application of Medical Gases

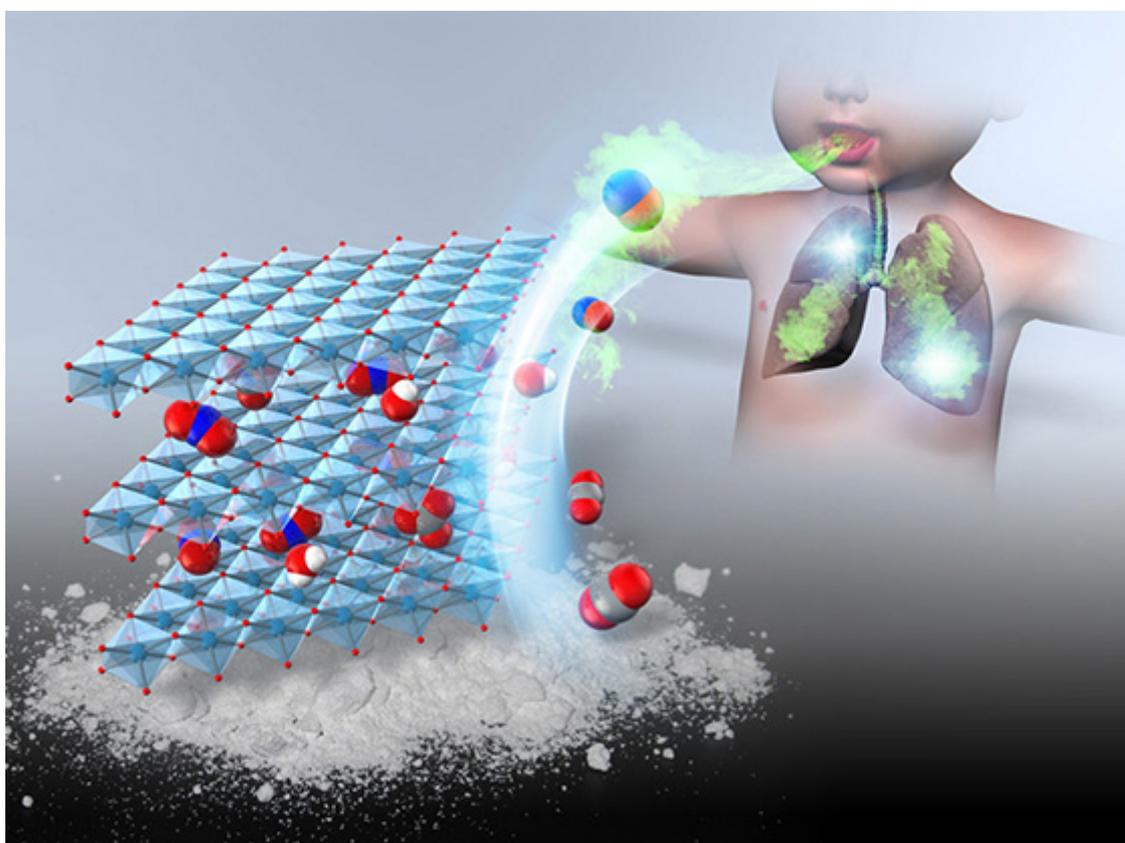
[Previous](#)

[Index](#)

[Next](#)

24 Aug, 2020

Hydrogen sulfide (H_2S) and nitric oxide (NO) are gases with useful bio-activities, such as anti-oxidation, anti-inflammation and vasodilation. H_2S is an ingredient in hot spring and long known to have positive effects on the skin and cardiovascular system. NO is a selective and fast-acting pulmonary vasodilator, and is used in hospital intensive care units to treat severe respiratory distress, including the so-called “blue-baby syndrome,” a life-threatening condition caused by pulmonary hypertension. In addition, the inhaled NO therapy is currently under clinical trials for COVID-19 infection.



However, the application of these gases is limited since they are toxic at high concentrations and need cumbersome high-pressure gas cylinders. For example, inhaled NO is an advanced medical treatment requiring expensive medical instruments and a trained operator to control and monitor the purity and dose of the NO.

To address these issues, a MANA research team of Shinsuke Ishihara and Nobuo Iyi has developed solid materials that slowly and autonomously release small amounts of H_2S and NO when they contact with CO_2 in air. The materials are based on layered double hydroxide (LDH), a clay

mineral, which incorporates gas source anions (HS^- or NO_2^-). The materials exchange anions with CO_2 and release H_2S and NO .

The concentration and duration of gas release are controllable by adjusting various factors, such as composition of materials, diffusion of gas molecules and anions, and chemical equilibrium.

The team's low-cost and safe-to-handle materials could be used to create a disposable medical system for controlled release of bio-active gases under ambient air. Actually, the team demonstrated the potential utility of new gas-release system by creating a portable, hand-operated (and therefore battery-free) respirator that can supply therapeutically useful quantities of NO into inhaled air.

The work shows that LDH is an attractive material for gas release, and the CO_2 -driven system is potentially useful for expanding opportunities of utilizing functional gases in a variety of applications.

This research was carried out by [Shinsuke Ishihara](#) (Principal Researcher, Frontier Molecules Group) and [Nobuo Iyi](#) (Special Researcher, Soft Chemistry Group).

Reference

"Controlled Release of H_2S and NO Gases Through CO_2 -Stimulated Anion Exchange"

[Shinsuke Ishihara](#) and [Nobuo Iyi](#)

Journal : Nature Communications [January 23, 2020]

DOI : [10.1038/s41467-019-14270-3](https://doi.org/10.1038/s41467-019-14270-3)

(Press release on this research)

"Development of a Solid Material Capable of Slowly Releasing H_2S and NO " (24 January 2020)

https://www.nims.go.jp/mana/news_room/press/2020012401.html

(MANA E-BULLETIN)

<https://www.nims.go.jp/mana/ebulletin/>

Affiliations

International Center for Materials Nanoarchitectonics (WPI-MANA), National Institute for Materials Science (NIMS), Namiki 1-1, Tsukuba, Ibaraki 305-0044, Japan

Contact information

International Center for **Materials Nanoarchitectonics**(WPI-MANA)

National Institute for Materials Science

1-1 Namiki, Tsukuba, Ibaraki 305-0044 Japan

Phone: +81-29-860-4710

E-mail: [mana-pr\[at\]ml.nims.go.jp](mailto:mana-pr[at]ml.nims.go.jp)

