# News Release

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# Fast, Cheap, and Accurate: Detecting $CO_2$ with a Fluorescent Twist

Kyoto, Japan -- Detecting specific gases in the air is possible using a number of different existing technologies, but typically all of these suffer from one or more drawbacks including high energy cost, large size, slow detection speed, and sensitivity to humidity.

Overcoming these deficiencies with a unique approach, a team based at Kyoto University has designed an inexpensive new material capable of quick and accurate detection of a specific gas under a wide variety of circumstances. Moreover, in addition to being reusable, the compound gives off variable degrees of visible light in correspondence with different gas concentrations, providing for development of easy to use monitoring devices.

The findings, published in a recent issue of Nature Materials, describe the use of a flexible crystalline material (porous coordination polymer, or PCP) that transforms according to changes in the environment. When infused with a fluorescent reporter molecule (distyrylbenzene, or DSB), the composite becomes sensitive specifically to carbon dioxide gas, glowing with varying intensity based on changing concentrations of the gas. Lead author for the paper was Dr. **Nobuhiro Yanai** of the university's Graduate School of Engineering.

"The real test for us was to see whether the composite could differentiate between carbon dioxide and acetylene, which have similar physiochemical properties," explains Assoc. Prof. **Takashi Uemura**, also of the Graduate School of Engineering. "Our findings clearly show that this PCP-DSB combination reacts very differently to

the two gases, making accurate $CO_2$ detection possible in a wide variety of applications."

In its natural state, DSB is a long, flat molecule, which emits a blue light. When adsorbed by the PCP framework, DSB molecules twist, causing the entire PCP structure to also become skewed. In this condition, the glow of DSB diminishes significantly.

"On this occasion we observed that the presence of $CO_2$ causes the DSB molecules to revert to their flat, brightly fluorescent form, while also returning the PCP grid to its usual state," adds Professor and deputy director **Susumu Kitagawa** of the university's Institute for Integrated Cell-Material Sciences (iCeMS). "And importantly, these steps can be reversed without causing any significant changes to the composite, making possible the development of a wide variety of specific, inexpensive, reusable gas detectors."

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The article, "**Gas detection by structural variations of fluorescent guest molecules in a flexible porous coordination polymer**" by Nobuhiro Yanai, Koji Kitayama, Yuh Hijikata, Hiroshi Sato, Ryotaro Matsuda, Yoshiki Kubota, Masaki Takata, Motohiro Mizuno, Takashi Uemura, and Susumu Kitagawa was published online in the September 4, 2011 issue of ***Nature Materials***.

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**About the iCeMS** **www.icems.kyoto-u.ac.jp**

Established to integrate the cell and material sciences, the iCeMS combines the potential power of stem cells (e.g., ES/iPS cells) and of mesoscopic sciences to benefit medicine, pharmaceutical studies, the environment, and industry. Its founding director is Prof **Norio Nakatsuji**, Japan's pioneer in the establishment and distribution of human ES cell lines, and a leader in ES/iPS cell-based drug discovery.