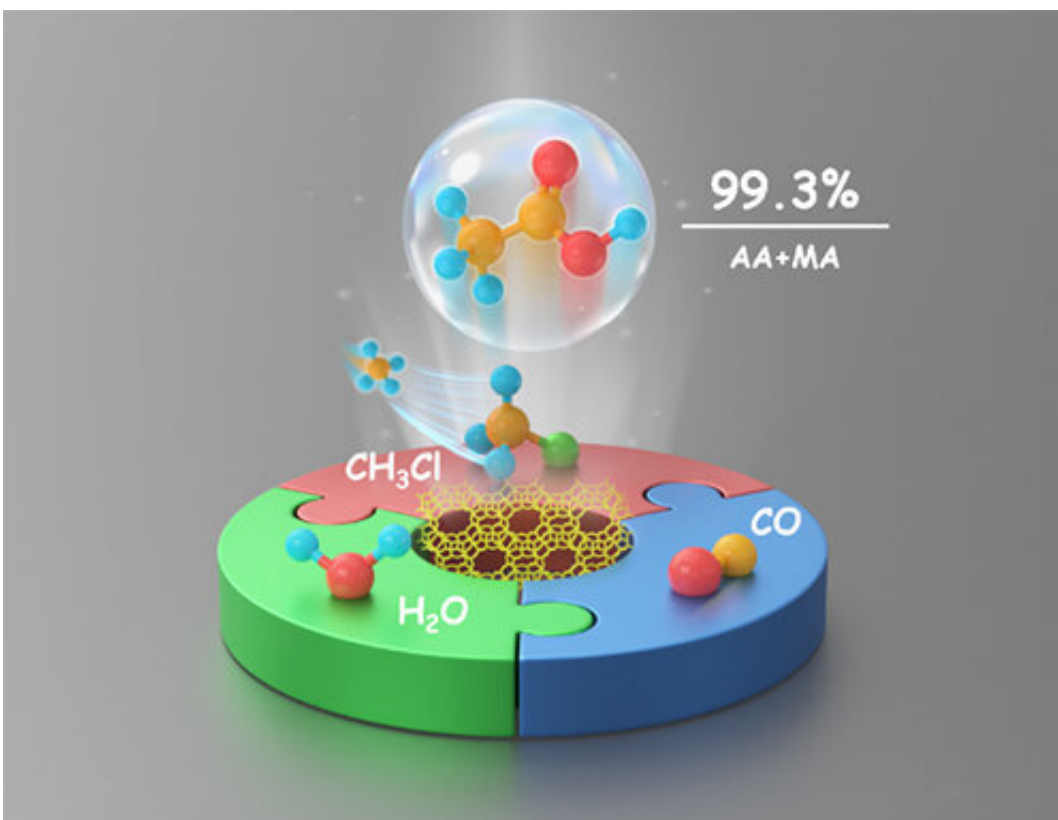


# Direct transformation of CH<sub>3</sub>Cl to acetic acid through a carbonylation reaction

June 6 2022, by Li Yuan



Highly selective carbonylation of CH<sub>3</sub>Cl to acetic acid catalyzed by pyridine-treated MOR zeolite. Credit: Fang Xudong

Methane, the main component of natural gas, shale gas and flammable ice, is a clean and inexpensive chemical feedstock with abundant reserves. Nevertheless, the high C-H bond energy and low polarizability

of a methane molecule inhibit the utilization of methane.

Recently, a research team led by Prof. Liu Zhongmin and Prof. Zhu Wenliang from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) developed a novel route to directly transform  $\text{CH}_3\text{Cl}$  to acetic acid through a carbonylation reaction using acidic zeolites as the catalyst.

The study was published in *Angewandte Chemie International Edition* on May 30.

The researchers used pyridine-treated MOR as catalysts to achieve high acetic acid and methyl acetate selectivity. They found that the coupling of  $\text{CH}_3\text{Cl}$  with  $\text{CO}$  and  $\text{H}_2\text{O}$  occurred over acidic zeolites especially one-dimensional with 8-member ring (8 MR) or 10-member ring (10 MR).

In particular, the selectivity of [acetic acid](#) and methyl acetate reached 99.3% over pyridine-treated MOR under the optimized conditions, which was superior to that of Rh/AC under  $\text{CH}_3\text{I}$ -free conditions. The Bronsted acid sites in 8 MR were proven to be the main active site for chloromethane carbonylation.

Moreover, with multiple characterizations, the researchers proposed the [reaction mechanism](#) which included the chemical adsorption of  $\text{CH}_3\text{Cl}$ , the formation of acetyl groups, and the hydrolysis of acetyl groups.

"Our study may present potential in the efficient and practical transformation of [methane](#) into oxygenates in the future," said Prof. Zhu.

**More information:** Xudong Fang et al, Highly Selective Carbonylation of  $\text{CH}_3\text{Cl}$  to Acetic Acid Catalyzed by Pyridine-Treated MOR Zeolite, *Angewandte Chemie International Edition* (2022). [DOI:](#)

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