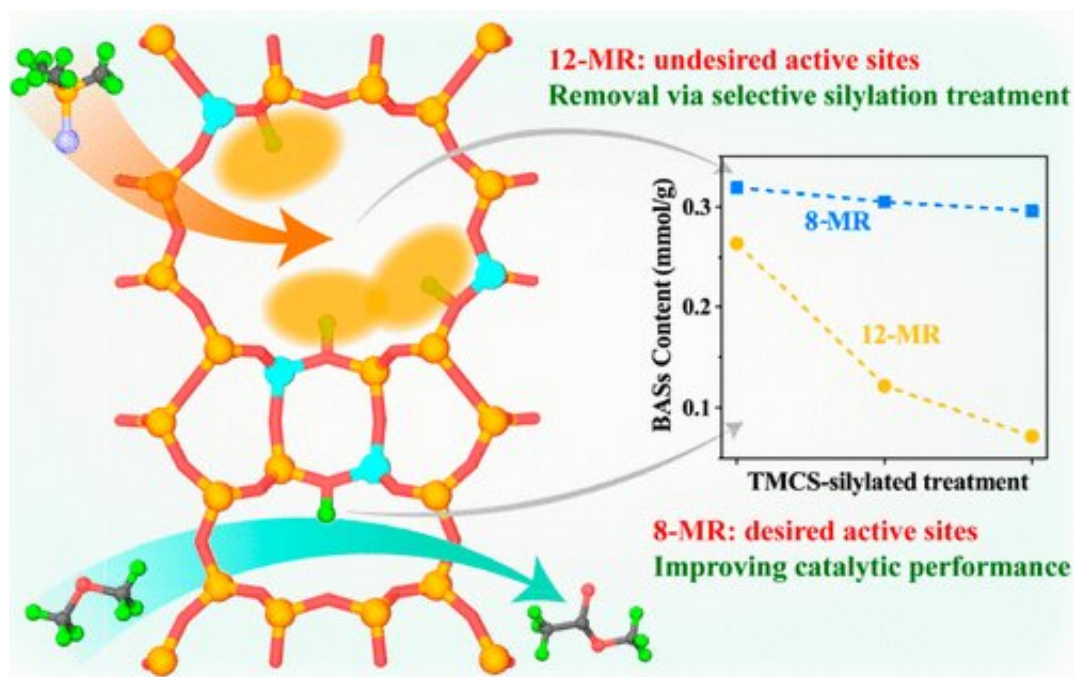


# New strategy to control distribution of acid sites in zeolites

April 7 2022, by Li Yuan



Graphical abstract. Credit: *ACS Catalysis* (2022). DOI: 10.1021/acscatal.1c05896

Zeolites are one of the shape-selective catalysts. The characteristics of zeolites, which come from the structural confinement on the molecular dimensions, are crucial for shape-selective catalysis.

The catalytical acid sites at different positions of [zeolites](#) show a distinct confinement effect for reactant molecules, especially reflected in mordenite (MOR) zeolite catalyzing dimethyl ether (DME)

carbonylation reaction.

Recently, a research team led by Prof. Liu Zhongmin from the Dalian Institute of Chemical Physics of the Chinese Academy of Sciences (CAS) developed a new strategy to preferentially remove the acid sites in the 12-membered ring (12-MR) channels of MOR zeolite by a trimethylchlorosilane (TMCS) silylation treatment, which could improve the performance of DME carbonylation.

This study was published in *ACS Catalysis* on April 1.

The 8-membered ring (8-MR) channels of MOR zeolite are preferred for the selective carbonylation of DME, while the larger 12-MR channels can accommodate more reaction routes, which will cause rapid deactivation of the MOR zeolite. Therefore, it is necessary to selectively remove the acid sites in 12-MR channels of MOR to improve its [catalytic performance](#) in the DME carbonylation reaction.

The researchers used in situ diffuse reflectance infrared Fourier transform (DRIFT) and  $^{29}\text{Si}$  cross-polarization (CP) Nuclear Magnetic Resonance (NMR) spectroscopic techniques to investigate the interaction of TMCS molecules with the bridging hydroxyl groups within different positions of the H-mordenite (HMOR) zeolite.

They found that TMCS molecules bridged the HMOR framework via a hydrolysis reaction between chloro groups and Brønsted  $\text{H}^+$  atoms to cover the acid sites. Due to the space limitation, the silylation treatment selectively retained most of the acid sites (80%) in the desired position by TMCS replacing the Brønsted  $\text{H}^+$  atoms within 12-MR channels in the HMOR zeolite, leading to better selectivity and a much longer lifetime in the DME carbonylation reaction.

**More information:** Rongsheng Liu et al, Selective Removal of Acid

Sites in Mordenite Zeolite by Trimethylchlorosilane Silylation to Improve Dimethyl Ether Carbonylation Stability, *ACS Catalysis* (2022).  
[DOI: 10.1021/acscatal.1c05896](https://doi.org/10.1021/acscatal.1c05896)

Provided by Chinese Academy of Sciences

Citation: New strategy to control distribution of acid sites in zeolites (2022, April 7) retrieved 23 June 2024 from <https://phys.org/news/2022-04-strategy-acid-sites-zeolites.html>

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