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|  |  |  הטכניון - מכון טכנולוגי לישראל TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY  |
| הפקולטה להנדסה כימיתע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Wednesday, September 1st, 2021 at 13:30**

**Online seminar via Zoom**

<https://technion.zoom.us/j/98982676170>

**Room Temperature Oxidation of Formaldehyde over Bimetallic Oxides and Their Supported Catalysts**

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Formaldehyde (HCHO) is considered one of the major contributors to indoor air pollution. Designing a highly active and low-cost catalyst is extremely significant for improving catalytic oxidation of gaseous HCHO.

Herein, the Fe-Mn(1:1) nanoparticle catalyst was prepared by sol-gel methods and used for catalytic oxidation of gaseous HCHO. The morphology, crystalline structure, and surface redox property have been investigated by SEM, XRD, and H2-TPR. Results showed that the ratio of adsorbed oxygen and lattice oxygen could be modulated by simply modifying the ratio of Fe/Mn, where the adsorbed oxygen is essential for the catalytic oxidation of formaldehyde. The catalyst demonstrated high activity for formaldehyde molecules (100%) and great stability (20 h) at high GHSV (150 L g-1 h-1) at room temperature. This is the first report exhibiting high activity over such a high GHSV. The reaction mechanism has been investigated systematically by DRIFTS, revealing that the di-oxymethylene (DOM), HCOO- and carbonate were the key intermediates for converting the HCHO to CO2 and H2O. The catalyst could be easily recycled using its magnetic property and regenerated efficiently by hydrogen peroxide or heat treatment over three times.

The deactivation mechanism of catalyst revealed that the active sites of catalyst were covered by intermediates after reaction characterized by series of characterizations, such as FTIR, XPS, and H2-TPR. To improve the catalytic oxidation performance of formaldehyde, the Fe-Mn(1:1) are supported in the γ-Al2O3 and SBA-15 with porous structure and TiO2 (P25) to obtain highly dispersed and abundant active sites. The Fe-Mn(1:1) was supported on P25 with neutral surface redox property, which is beneficial for the desorption of intermediates and the activity recovery of catalyst. The Fe-Mn/P25 exhibited a high conversion (100%), excellent stability (19 h), and good photo-regeneration (over three times).

These works provide a profound perspective for understanding the reaction mechanism and low-temperature catalytic oxidation of volatile organic compounds over non-noble metal catalysts.