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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**

**Monday, August 26th, 2024 at 13:30**

**Room 4**

**Understanding the Effect of Ni-Support Interaction in a Hierarchical Catalyst on the DRM Reaction: The Impact of Ni Species Spatial Distribution and Ni, Co Adsorption Sequence**

**Jin Wang**

**PhD Seminar**

Advisor: Prof. Oz M. Gazit

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Dry reforming of methane (DRM) is a promising method for reducing greenhouse gas emissions and producing syngas. Catalysts based on nickel (Ni) have been extensively researched as candidates for DRM due to their high catalytic activity and cost-effectiveness. However, their commercial use is limited by the low Tammann temperature, leading to sintering and coke formation. Studies have shown that both deactivation processes can be attenuated through adjustment of metal-support interactions (MSI). We demonstrated that Ni nanoparticles can be stabilized using a hierarchical low-dimensional support material composed of thin MgAlOx supported on an underlying ZrO2 (MgAlOx/ZrO2, denoted as MAZ). This unique hierarchical arrangement mediates the strong-MSI of MgAlOx by the weak-MSI attributed to the underlying ZrO2.

In the 1st part of the seminar, I will focus on discussing the impact of the spatial distribution of Ni species within MAZ on MSI and the performance of DRM. Our results suggest that heterointerfacial sites can be used to tailor moderate MSI and obtain DRM catalyst with significantly increased activity and high stability by cross-referencing our catalytic data with high-angle annular dark-field scanning transmission electron microscopy - energy dispersive X-ray spectroscopy (HAADF-STEM-EDS), X-ray photoelectron spectroscopy (XPS) and density function theory simulations.

In the 2nd part of the seminar, catalysts discussed in the previous section were further enhanced by introducing another transition metal: cobalt (Co). The effect of Ni/Co adsorption sequence on the MSI was investigated and the catalyst performance at low temperature was evaluated. We found that varying the Ni/Co adsorption sequence produces Ni-Co alloys with different surface Ni/Co ratios, which in turn significantly influences the catalyst performance in DRM and catalysts activation condition. X-ray absorption near-edge structure (XANES)/X-ray absorption fine structure (XAFS), HAADF-STEM-EDS and XPS were applied to establish a structure-function relationship.

Refreshments will be served at 13:15.