Characterization of Bimetallic and Carbide Catalysts under Reaction Conditions

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Bimetallic and carbide catalysts often demonstrate enhanced catalytic properties over the corresponding parent metals. It is important to understand how the structural and electronic properties of these catalysts change under reaction conditions. In the current presentation we will provide two examples to illustrate the importance of utilizing synchrotron-based techniques for in-situ characterization. In the first example extended X-ray absorption fine structure (EXAFS) was utilized to determine the structural changes in a Ni-Pt catalyst during the reforming reaction of ethylene glycol. These results showed that the catalyst was primarily Pt-terminated in the presence of hydrogen, which changed to Ni-terminated in the presence of ethylene glycol. In the second example ambient-pressure XPS and in-situ XANES were employed to determine the active sites of molybdenum carbide (Mo_2C) for the catalytic reduction of CO_2 by H_2. These measurements revealed that Mo_2C underwent cycling between carbide and oxy-carbide during the reaction. These examples highlight the importance of in-situ techniques in providing insights into the reaction mechanism and pathways.