USING WIDE SPECTRAL RANGE INFRARED SPECTROSCOPY TO OBTAIN BOTH SURFACE SPECIES AND CHANGES OF CATALYST ITSELF UNDER THE REACTION CONDITIONS

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Fundamental understanding of catalysts under the reaction conditions is key for designing new catalysts, and improving catalysts and catalytic conversion processes. Such understanding can be achieved only by characterization of catalysts under the reaction conditions because catalyst structures and the mechanisms of catalytic reactions depend on the reaction environment. Raman spectroscopy is one of the few instrumental methods that in a single measurement can provide information about both solid catalysts and the molecules reacting on them. However, its sensitivities for the surface species and the surface changes under catalytic reaction are limited. Infrared spectroscopy is also a wide spectral range (6000-50 cm-1) technique that enables examination of the nature of molecular species, identification of solid phases. Unfortunately, most of the heterogeneous catalysts consist of oxides as the active components or as the supports, which strong IR adsorption (below 1200 cm-1) limits the in situ IR to measure only the surface species (4000 900 cm-1). In this presentation, we will present our new developments of in-situ infrared spectroscopies with a spectral range of 4000 400 cm-1, for both the reflection adsorption infrared spectroscopy (IRAS) and transparent infrared spectroscopy (FTIR, unpublished data), that are capable of measuring both the surface species and changes specific to the surface.