Structure-function studies of heterogeneous rhodium catalysts

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By combining energy dispersive EXAFS (EDE) with mass spectrometry the structure of Rh/alumina catalysts can be correlated with their activity and selectivity during in situ investigations using a flow reactor under reaction conditions. In addition, a third technique, diffuse reflectance Fourier transform infra red spectroscopy (DRIFTS) has been incorporated to probe the adsorbates on the catalyst surface. Using the Frelon camera as the detector on ID24, a repetiton rate of ~50ms for all of these techniques can be achieved. These experiments provide a high density of information in experimental phase space (temperatures, gas compositions). For redox reactions related to the automotive exhaust catalyst, such as the CO/O2, NO/H2 and CO/NO conversions, the structures of the metal nanoparticles respond rapidly to the ambient gases and to the temperature. The catalytic properties in turn are dependent upon the nature of the predominant phase.