Applications of Nanoparticles in Gas-phase Catalytic Reactions

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In recent heterogeneous catalysis, much effort has been made in understanding how the size, shape, and composition of nanoparticles and oxide-metal interfaces affect catalytic performance at the molecular level. In this presentation, gas-phase heterogeneous catalytic reactions are addressed including benzene, toluene, and hexane hydrogenation and carbon monoxide oxidation. It is demonstrated the highest reaction yield, product selectivity, and process stability in catalytic reactions are achieved by determining the critical size, shape, and composition of nanoparticles and by choosing the appropriate oxide support, *In situ* surface characterization techniques including Near Edge X-ray Absorption Fine Structure (NEXAFS) and Ambient Pressure X-ray Photoelectron Spectroscopy (APXPS) are utilized for real-time monitoring of nanoparticle catalysts under reaction conditions, in order to identify molecular factors affecting catalytic activity, selectivity, and stability.