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IN SITU MODULATION EXCITATION IR SPECTROSCOPY IN ENVIRONMENTAL CATALYSIS: NOX REMOVAL BY AU CATALYSIS

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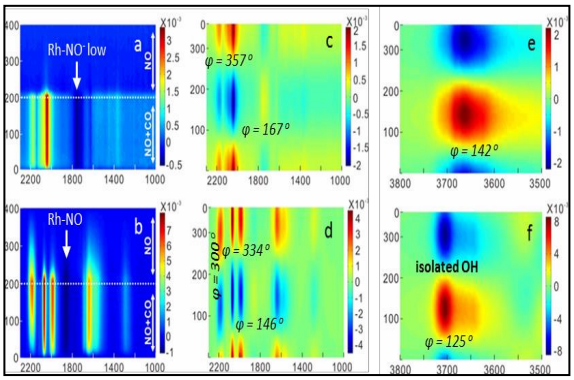
One of the greatest challenges for in situ characterization by Fourier transform infrared (FTIR) spectroscopy for environmental catalysis is to discriminate active species from spectator species dominating the surface under steady-state reaction conditions. Hence, the selective extraction of active species would be especially valuable for analyses of heterogeneous catalysts. A transient spectroscopic technique, modulation excitation spectroscopy (MES), was reported for the selective discrimination by operating under an unsteady-state condition with a periodic external perturbation, e.g. concentration. The phase sensitive detection (PSD) was additionally applied to transform time-domain spectra to phase-domain spectra1. Recently, we have applied this state-of-the-art spectroscopic technique for NO reduction by CO over AuRh/TiO_2 nanowire (NW) catalysts. Figure 1 shows in situ MES-IR spectra under NO-modulated NO-CO reaction on AuRh/TiO_2 and AuRh/TiO_2-NW. MES combined with PSD increased the signal-to-noise (S/N) ratio, and time-resolution even in the low absorbance range. Extraction of kinetic information of adsorbed CO and NO on Au and Rh surfaces, isocyanate species (–NCO), hydrogen-bonded OH and isolated OH on support materials were clearly displayed in the phase-domain spectra. Negative NO bands (highlighted in blue) in Figures 1a and 1b demonstrates the NO molecules adsorb differently on TiO_2 and TiO_2-NW. The phase-domain spectra (Figures 1c, 1d, 1e and 1f) display a dynamic perspective on the catalytic cycles:-NCO formation on isolated OH groups and its reaction with NO to produce final products, i.e., N_2 and CO_2. Figure : (a, b) time- domain; (c, d, e, f) phase-domain spectra during periodic change in the gas-phase compositions between NO + CO and NO over (a, c, e) AuRh/TiO_2 and (b, d, f) AuRh/TiO_2-NW catalysts.



BIOGRAPHY

Xianwei Wang is the PhD candidate in School of Environmental Science & Technology, Dalian University of Technology, China. He did his research on Catalytic reduction of nitric oxide by carbon monoxide. Synthesis and modification of Au-based catalysts Application of in situ modulation excitation infrared spectroscopy for monitoring catalytic solid-gas and solid-liquid interfaces and also the In situ ATR-IR Spectroscopic study of catalysts surfaces under high pressure and temperature

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