SF-P007

Revisiting H_2 and CO Interactions with Pt(111) Surfaces

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The importance of stepped single-crystal surfaces as model catalysts has been well recognized [1]. We re-investigated the adsorption properties of H_2 and CO, most important species in platinum-based catalysts, on nearly defect-free and highly stepped surfaces of one and the same Pt(111) crystal. While both being symmetric and single-peaked from the nearly defect-free surface, temperature-programmed desorption (TPD) spectra from the highly stepped surface saturated at 90 K with H and CO were triply- and doubly-peaked, respectively. Once pre-adsorbed, CO preempted step and then terrace sites, inhibiting the dissociative H_2 adsorption completely. Pre-adsorbed H inhibited the CO adsorption on terrace sites only, leaving defect sites intact for CO adsorption even at the saturation H precoverage. On defect-free Pt(111), while pre-adsorbed CO inhibited the dissociative H_2 adsorption completely, pre-adsorbed H could not inhibit the CO adsorption completely. These intriguing, but interesting results are discussed in terms of energetics/kinetics and the role of surface step sites in the dissociative adsorption of H_2 on Pt(111) [2].

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Keywords: Hydrogen, CO, adsorption, Pt(111)