



Heterogeneity of Adsorption and Reaction Sites on Silica Supported (10%Co+0.5%Pd) Catalyst Surfaces During CO Hydrogenation

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Heterogeneity of adsorption and reaction sites of Co-Pd/SiO₂ catalysts for CO hydrogenation was studied by chemisorption, TPD, and DRIFTS. Precursor materials were treated in H₂, Ar, or air and named respectively as (red), (inert), or (ox). CO conversion changed in low extent due to effect of preliminary treatment. Activity of samples in synthesis of CH₄ ranged as (inert)<(ox)<(red) and decrease of 18-24% was registered. H₂ adsorption showed similar heterogeneity of (red) and (inert) samples as their low-energy sites were weaker than those of (ox) one. The most hindered H₂ adsorption was registered on (ox) catalyst. High-temperature TPD region analysis revealed (inert)-type of catalyst as an owner of more stable H₂ adsorption sites compared to the other materials. Thus, heterogeneity was also of same type. Infrared bands of linear CO-Co⁰/Co^{δ+} species were of high almost constant intensity in the row (red)<(ox)<(inert) and low-temperature desorption peak T_{max} ranged as (inert)<(red)<(ox). Increased formation of mono- and bidentate carbonates and formate species was found with process progress. Respective CO-TPD region showed that the intermediate compounds on (inert) sample were more reactive in comparison to those from other samples. The observations allowed generalization that various linear CO species were formed on the surface; adsorption sites were strong; processes of adsorption, dissociation and hydrogenation on the surface were to a great extent balanced; adsorption site working as reaction center reduced its activity with time in CO hydrogenation and occurring of WGSR got more advantageous. Comparative analysis concerning carbonate-like species showed that adsorption sites/intermediates in case of (ox) sample were weak sites/unstable complexes and (inert) sample had adsorption centers/carbonate-like complexes of average strength/stability.

Keywords: CO hydrogenation; Co-Pd catalysts; adsorption and reaction sites

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