BEHAVIOUR OF PtCo ALLOY NANOPARTICLES IN REVERSE WATER-GAS SHIFT REACTION

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Abstract

The effects of atropogenic CO_2 emission are among today‘s most researched topics. One of the most promising approach is to convert the CO_2 into other compounds, which could be further converted into reagents for the chemical industry. This approach should let us reach carbon neutrality. The accumulation of CO_2 in the atmosphere is due to the stability of the molecule, thus a catalyst is required to activate CO_2 and break its bonds. In this project we demonstrate the performance of PtCo alloy nanoparticle systems. PtCo nanoparticles with different Pt:Co ratios (3:1, 1:1, 1:3) were synthesized with similar size and geometry. Pure Pt nanoparticles were also synthesized and were studied as a reference material. The metal content and ratios of the alloy particles were confirmed with IPC-MS. The particles were loaded onto an inert mesoporous silica, MCF-17. The catalyts materials were characterized via TEM, XRD, BET and HAADF (S)TEM. Catalytic activity for reverse water-gas shift reaction was tested in a countinous flow reactor, where the products where separated and detected by a GC. The difference in the catalytic behaviour was further elucidated with *in situ* DRIFTS and XPS and measurements. *In situ* DIRFTS allowed us to comprehend the mechanism of the ongoing reaction by identifying the intermediates in the gas phase and adsorbed on the surface of the catalyst. XPS of the nanoparticles also provided valuable information about the composition of the nanoparticles and how the different alloys are structured, as the peak binding energies of the Pt show significants shifts depending on the coordination with Co in the crystal lattice.