CO oxidation on SUPPORTED Iridium nanoparticles UNDER EXCESS O2 CONDITIONS: study of RATE hysterisis phenomenA

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Here we report on CO oxidation reaction under O2 excess conditions over Ir nanoparticles dispersed on Al2O3-Cex-Zr1-xO2 (ACZ, x=0, 0.25, 0.5 and 0.75) mixed oxide supports, which have high oxygen ion lability/mobility and surface oxygen vacancies. Multiple steady states of reaction rate *versus* temperature, the so-called rate *hysteresis* phenomena, have been observed during an increasing-decreasing cycle of temperature at the interval of 50-400 oC. Particular emphasis was invoked on understanding the origin of these phenomena and their correlation with the nature of the supporting materials in relation to the oxygen storage capacity characteristics of the latter and the consequent metal-support interactions. The effect of catalyst preparation method on CO oxidation activity and on hysteresis phenomena has been also involved in the present study. For this purpose, the ACZ supports were prepared following two synthesis methods, co-precipitation and hydrothermal, while in both cases Ir was dispersed on the supports by the wet impregnation method. Several protocols of kinetic experiments were designed to shed light on the aforementioned phenomena: (i) A series of cyclic experiments, i.e. ignition (light-off) followed by extinction (light-out) at the temperature range of 50-400oC and constant reactor feed conditions (1.0% v/v CO, 5.0% v/v O2 balanced with He, FT=160 mL/min, wGHSV=320000 mL/gcath); (ii) kinetic experiments on pre-reduced (with a 25% H2/He­ flow at 350 oC for 0.5h) and pre-oxidized (with 20% O2/He flow at 400 oC for 1 h) catalysts; and finally (iii) kinetic experiments on gradually aged catalysts at high temperature oxidative conditions according to a specific aging protocol. In addition, the textural and stuctural properties of the supports and the Ir-ACZ catalysts were evaluated by various techniques, such as X-ray diffraction (XRD), BET-BJH N2 adsorption-desorption method, temperature-programmed reduction by H2 (H2-TPR) and isothermal H2 chemisorption (H2-Chem) in order to gain a better understanding of the relevant structure-activity relationships and hysteresis phenomena implicated.

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