Drifts and TPD Analyses of Ethanol on Pt Catalysts Over Al_2O_3 and ZrO_2—Partial Oxidation of Ethanol

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Ethanol adsorption on platinum catalysts supported on Al_2O_3 and ZrO_2 was studied by temperature-programmed desorption (TPD) and DRIFTS analysis. TPD of ethanol showed that the alumina support favoured the dehydration and decomposition ethanol, besides the water–gas shift reaction. DRIFTS analyses showed different intermediate species on the Pt/Al_2O_3 and Pt/ZrO_2 catalysts. On the Pt/Al_2O_3 catalyst it was observed formation and decomposition of acetate species. On the Pt/ZrO_2 were observed ethoxy species. Catalytic tests of the partial oxidation of ethanol showed that the H_2 selectivity was higher on the Pt/Al_2O_3 compared to the Pt/ZrO_2 catalyst. Marked difference was observed for the H_2/CO ratio, suggesting preferential WGSR for Pt/Al_2O_3 and the *reverse* WGSR for the Pt/ZrO_2 catalyst. These results allowed proposing different reaction routes.

Keywords: ethanol, drifts, platinum, alumina and zirconia, mechanism

INTRODUCTION

The growing global demand for energy and the call for a tougher environmental legislation have pointed to the need of developing eco-friendlier technologies that can meet the increased energy demand.

Accurate surveys made in recent years about the energy matrix indicate between complementary sources of oil and hydroelectricity the natural gas and biomass (including the ethanol).

Brazil is recognised as a pioneer in using ethanol in the energetic matrix. Since the first program "Pro-alcool" 30 years ago, the production or ethanol increased from 700 million litres to 15 billion litres around 2006. More than 53% is used as fuel for vehicles (SECEX, 2005).

Today, most industries working with oil and operating in many sectors of general assistance to population, dispersed all over the country such as transport, hospitals, airports, among others, need alternative fuels. Recently, combustors and reformers for natural gas, hydrogen fuel cells, and diesel or liquid fuels production from synthesis gas using natural gas, ethanol and other biomass as raw material have been proposed as alternative to power sources. All of them are considered available or with high potential of production (Goldemberg et al., 2002). Ethanol will be used as fuel for stationary fuel cells. In this particular case, there are several research groups developing processes and catalysts for hydrogen production through auto-reforming and partial oxidation of ethanol and for the construction of cells (Proton Exchange Membrane (PEM) and Solid Oxide Fuel Cell (SOFC)) (Linardi, 2008).

Actually, the processes for hydrogen production are already in current use in different industries, applying natural gas or naphtha and well-established conventional catalysts. However, the amount of hydrogen required to power applications is huge; hence, the need to seek alternative energy sources, preferably renewable sources, such as ethanol.

Bio-ethanol, presented as an environmentally fuel (renewable, CO_2 neutral, non toxic), is used in catalytic steam reforming reaction or in partial oxidation for H_2 onboard production.

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