

This PhD work provides understanding on the palladium deposition on cerium-praseodymium mixed oxides prepared with different synthesis methods. Palladium was indeed deposited on low- and high-surface area Ce-Pr supports and different cerium-to-praseodymium ratios were taken into account. These materials were comprehensively characterized with standard and advanced characterization techniques and tested for the methane oxidation reaction in dry (without water in the reaction chamber) and wet (with water in the reaction chamber) conditions. The deposition of the noble metal on Pd/CeO₂ systems resulted in an active system in the 100-500 °C temperature range. However, these materials suffer from the presence of a consistent activity loss at 700-800 °C due to the transformation of palladium oxide into metallic palladium. Also, water turned out to be an important poison for this kind of catalysts. Praseodymium was rationally chosen as dopant for Pd/CeO₂ materials due to its ability of retain palladium in a more oxidized form. Praseodymium oxide is also a non-expensive material with enhanced redox properties. In this context, the deposition of Pd on Ce-Pr materials with high Pr percentage (Pr percentage \geq 25 at%) led to the formation of catalysts with low activity between 100 and 500 °C but marked stability in the 500-900 °C range. This was due to the presence of strong interactions between PdO and PrO_x oxides, maintain the palladium in a stable oxidized form. On the other hand, the deposition of palladium on catalysts with a low amount of Pr (Pr percentage = 5, 10 at%) resulted in the formation of highly active systems. The activity of these materials was indeed greater compared to the one of Pd/CeO₂ systems. This promising performance in the low-temperature region was ascribed to the presence of diversified palladium species (i.e. reduced and oxidized). The latter take part in the reaction mechanism, especially in the Mars van Krevelen one. Moreover, these kinds of materials seemed to be promising in the high-temperature area with intermediate performance between Pd/CeO₂ and Pd on Ce-Pr catalysts with high Pr amount. As a matter of fact, the activity loss expected at 700-800 °C was lower than the one of Pd/CeO₂, but higher compared to the one of Pd/Ce75Pr25, Pd/Ce50Pr50 and Pd/Pr100. Overall, the deposition of palladium on Ce90Pr10 and Ce95Pr5 can be considered a good compromise to obtain catalysts with high activity in the low temperature range (100-500 °C) and good stability (in terms of reducing the high-temperature loss of activity) at high temperatures (500-900 °C). Finally, it appeared that the activity reduction due to the presence of water can be reduced on Pd/Ce90Pr10 systems. This material turned out to be promising also in the tests carried out in the presence of water in the entering flow. This phenomenon was confirmed by studying the interactions between the materials and water or hydrocarbons. In fact, great hydrocarbons-catalyst affinity coupled with weak water-catalyst interactions were noted on Pd/Ce90Pr10. On the whole, this PhD work gives new insight about the characterization of Pd/Ce-Pr materials and their applications in both dry and wet methane oxidation. The interesting results obtained together with the different studies employed can pave the way for using Pd/Ce90Pr10 and Pd/Ce95Pr5 in practical applications.