

## Catalytic Combustion of Methane over Pd-Meox-CeO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub> (Me= Co or Ni) Catalysts

**Authors :** Silviya Todorova, Anton Naydenov, Ralitsa Velinova, Alexander Larin

**Abstract :** Catalytic combustion of methane has been extensively investigated for emission control and power generation during the last decades. The alumina-supported palladium catalyst is widely accepted as the most active catalysts for catalytic combustion of methane. The activity of Pd/Al<sub>2</sub>O<sub>3</sub> decreases during the time on stream, especially under water vapor. The following order of activity in the reaction of complete oxidation of methane was established: Co<sub>3</sub>O<sub>4</sub> > CuO > NiO > Mn<sub>2</sub>O<sub>3</sub> > Cr<sub>2</sub>O<sub>3</sub>. It may be expected that the combination between Pd and these oxides could lead to the promising catalysts in the reaction of complete methane. In the present work, we investigate the activity of Pd/Al<sub>2</sub>O<sub>3</sub> catalysts promoted with other metal oxides (MO<sub>x</sub>; M= Ni, Co, Ce). The Pd-based catalysts modified by metal oxide were prepared by sequential impregnation of Al<sub>2</sub>O<sub>3</sub> with aqueous solutions of Me(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O and Pd(NO<sub>3</sub>)<sub>2</sub>·H<sub>2</sub>O. All samples were characterized by X-ray diffraction (XRD), temperature-programmed reduction (TPR), and X-ray photoelectron spectroscopy (XPS). An improvement of activity was observed after modification with different oxides. The results demonstrate that the Pd/Al<sub>2</sub>O<sub>3</sub> catalysts modified with Co and Ce by impregnation with a common solution of respective salts, exhibit the most promising catalytic activity for methane oxidation. Most probably, the presence of Co<sub>3</sub>O<sub>4</sub> and CeO<sub>2</sub> on catalytic surface increases surface oxygen and therefore leads to the better reactivity in methane combustion.

**Keywords :** methane combustion, palladium, Co-Ce, Ni-Ce

**Conference Title :** ICESE 2019 : International Conference on Environmental Science and Engineering

**Conference Location :** Athens, Greece

**Conference Dates :** October 21-22, 2019