REMOVAL OF CH_4 EMITTED BY CNG VEHICLES VIA Pd-SBA-15 AND Pd-KIT-6 MESOPOROUS SILICA CATALYSTS

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Advanced natural gas engines have considerable advantages over conventional gasoline and diesel engines from an environmental perspective. However, unburned methane is harder to oxidize than gasoline-derived unconverted HCs. The strong greenhouse effect of methane (more than one order of magnitude higher than that of CO_2) induces increasing concern at a legislation level and the development of tailored after treatment technologies. Catalytic oxidation of methane on honeycomb converters similar to those used for the treatment of gasoline engine exhaust gases is the way to go.

Commercial catalysts are mostly based on γ-Al_2O_3-supported Pd, having at least a three-fold higher noble metal loading compared to that of conventional three-way catalysts (up to 0.01 g/cm^3 against 0.003 g/cm^3). However, besides being expensive, the latter easily sinter. In this perspective, ordered mesoporous molecular sieves have a high surface area, pore volume and a narrow pore size distribution as compared with conventional zeolites and alumina materials. Because of these interesting properties, these materials played a role in heterogeneous catalysis as supports for metal oxides and metal catalysts for many types of reaction.

SBA-15 and in particular KIT-6 have here been used for the first time as supports for Pd catalysts for abatement of methane emitted by CNG engines: the pure supports, did not show any methane conversion, by the addition of Pd, the catalysts allowed to obtain complete combustion of CH_4. In both cases, the increase of Pd content led to a significant decrease of the temperature of complete oxidation, with an improve of about 200 °C from the lowest Pd content (0.33%) to the highest one (1%). In conclusion, the mesoporous silicas developed which show the best activity (SBA-15 1%Pd and KIT-6 1%Pd) can be considered very promising candidates, also considering that they contain five-times lower amount of noble metal compare to commercial Pd-catalysts, for the abatement of methane emitted by CNG vehicles.

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