Effect of Water on the Oxidation Reactions of CO and C_3H_6 over Modern Three-way Catalysts

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The presence of water has been reported to enhance the activity of the three-way catalysts (TWC) at low reaction temperature (< 250 °C) where the water gas shift (WGS) and steam reforming (SR) reactions are insignificant. However, the role of water for enhancing TWC activity at low temperature was not clearly verified yet. In the present study, the effect of water on the oxidation reactions of CO and C_3H_6 over the commercial TWC has been examined using an isothermal integral flow reactor immersed in a molten-salt bath. In addition, the catalyst characterization including CO-TPD and in-situ FT-IR has been also performed to investigate the role of water. When water was included in the feed stream, the light-off temperatures of the oxidation reactions have been shifted to the lower reaction temperature by the formation of carboxylate as an intermediate on the catalyst surface. Based upon the experimental results, the kinetic model for oxidation reactions of CO and C_3H_6 including water enhancement effect has been developed.