Complete oxidation of methane in catalyst-plasma hybrid reaction system

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As one of greenhouse gases, methane is recognized to contribute to the major portion of global warming. The stable C-H bond in methane requires the large amount of noble metal in catalyst to be oxidized completely at low temperature (i.e. below 500℃). Thus, we aim at lowering the light-off temperature by introducing the catalyst-plasma hybrid reaction system. The complete oxidation of methane is carried out in a dielectric barrier discharge(DBD) quartz tube reactor. Methane oxidation was evaluated over various catalysts in the presence or absence of plasma at the fixed plasma operating conditions. Also, to measure plasma effect, plasma power was calculated by V-Q Lissajous figures. Several palladium catalysts as well as non-palladium catalysts were prepared and applied. In the presence of plasma, light-off temperature of methane is shifted to lower temperature than catalyst-only condition. When the metallic property of catalyst increases in plasma condition, effect of plasma and conversion of methane decrease. In summary, it was found that plasma plays an important role in converting methane to CO/CO_2 in the temperature range where catalyst hardly works, thus leading to facilitate methane oxidation at lower temperature.