Atmospheric-Pressure Plasma-Assisted Selective Catalyst Reduction of NO_x with Hydrocarbon in Early State

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At low operating temperatures (? 300?), NO_x reduction by Ag/?Al_2O_3 with a hydrocarbon (n-C_7H_6) presents low conversion efficiency. When the temperature of exhaust gas fluctuates from time to time, it takes time to reach a set temperature for optimal NO_x reduction, so that it is necessary to improve the NO_x removal rate before the thermochemical steady state is reached. This work investigated the improvement of NO_x reduction over Ag/?Al_2O_3 in the early stage before reaching steady state, which is important for practical applications, focusing on the role of atmospheric-pressure plasma in the catalytic reduction of NO_x. The results revealed that the combination of plasma with catalyst could increase NO_x reduction efficiency by up to 50% at low operating temperatures where the catalyst-alone performance was low, depending on the temperature and specific input energy. Interestingly, the catalyst exposed with 265 ppm n-C_7H_{16} within 1 hour, this process increased NO_x removal rate in the early duration when comparison without n-C_7H_{16} expose at the same conditions. To sum up, the poor performance of the catalytic NO_x reduction at low temperatures in the early stage before reaching thermochemical steady state can be greatly be compensated for by using the atmospheric-pressure plasma generated in the catalyst bed.

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