CHEMICAL KINETICS IN PLASMA-ASSISTED CATALYTIC REDUCTION OF NO_x

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The goal of this work is to gain a fundamental mechanistic understanding of the plasma chemistry, and how the plasma affects the NO_x reduction activity, temperature operating window, and durability of various catalysts. Chemical kinetics models of the plasma and the catalyst have been developed and experimentally validated. With the plasma model we have been able to predict the electrical energy required to implement the reduction and oxidation processes in the plasma. For example, we have established the significance of hydrocarbons for lowering the electrical energy cost for conversion of NO_x and for suppressing the oxidation of $S0_2$. The effect of exhaust gas composition and plasma reactor design on the NO_x conversion chemistry have also been studied. With the catalyst model we have been able to develop a framework for deriving important kinetic parameters from a minimum number of experimental data for a particular lean-NO_x catalyst The kinetic parameters thus derived have enabled us to predict the dependence of the NO_x reduction efficiency on temperature, hydrocarbon level and space velocity. Finally we have been able to validate various hypotheses on how the plasma affects the NO_x reduction efficiency of various catalysts. The models enable us to predict the power and fuel requirements and performance of plasma-assisted catalysis during an engine transient cycle test.