reduction by corona discharge differed remarkably whether or not the oxygen existed in the mixture. In the spectrum of light emission from corona discharge in N2 or N2 + O2 mixtures, some N2 bands were detected. The ozone produced from an ozonizer was added into the mixture ([NO]=100ppm, N2 base) to compare the characteristics of DeNOx reaction in the case of corona discharge. In the case of NO+N2 mixtures, the process of NO reduction was mainly controlled by N2 radical. On the other hand, in the case of NO+N2+O2 mixture, NO was converted to NO2 and N2O5 by ozone from the corona discharge.

Fr1-4-2(#2)

The Effect of High-Frequency Electric Discharge on the Flame Front Self-Acceleration Processes in Pipes Closed at One End

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The object of the present paper is to investigate the effect of a high-frequency electric discharge whose voltage amplitude is maintained constant (constant-output-voltage-amplitude discharge) on deflagration-to-detonation transition. It has been experimentally demonstrated that a high-frequency constant-output-voltage-amplitude electric discharge, when applied to the flame zone in the case of the combustion wave propagating in pipes, will increase the turbulent flame front propagation velocity by approximately 1.5 times. Electric discharges have been shown, in qualitative terms, to affect flame zone turbulization.

Fr1-4-3(#41)

Optimization Study of Spray Detonation Inititiation by Electric Discharge

S.M. Frolov, V. Ya. Basevich, V.S. Aksenov, S.A. Polikhov

One of the challenging problems encountered in the development of pulse detonation engines is detonation initiation in fuel sprays at distances feasible for propulsion applications and with low energy requirements. This paper addresses the issue of minimization of the energy requirements for direct initiation of spray detonation. The effects of discharge location, energy deposition history, geometry and physical properties of the confinement, homogeneity and properties of fuel-air mixture, etc. have been studied experimentally. It has been shown that (i) it is worthwhile to use the discharge located at the closed end of the tube, (ii) the discharge area should be properly insulated to avoid electric loss

to metal walls, (iii) discharge duration should be minimized to at least 50 microseconds, (iv) the tube diameter should preferably be close to the limiting tube diameter, (v) gradual transition between the volume with electrical discharge and the tube should be used for cumulating the arising shock wave. To initiate detonation in n-hexane sprays, a nominal electric energy of 800 J was required for a tube 27 mm in diameter. The possibility of further decreasing the initiation energy by using a series of successively triggered discharges has been demonstrated.

Combustion Oscillations and Control I

Fr2-1-1(#212)

Model based Combustion Control; Theory to Application

A. Ghoniem

Model based control of combustion dynamics has been identified as an important enabling technology for operating combustion systems outside their "natural" performance envelope using a network of sensors that monitor the state, and control systems and actuators that supply feedback signals in forms that can impact the combustion mechanisms. One challenging area in which active control has been effective is in the control of combustion instability, also known as a thermoacoustic instability. A prerequisite to the design of optimal control strategies for these high amplitude and bandwidth phenomena is the availability of accurate models that describe the mechanism of the phenomenon and the system's response to external actuation. While models that describe the acoustic response of combustion systems to unsteady heat release have been known for sometime now, input-output relations between the heat release dynamics and the unsteady flow have become available only recently. These combustion dynamics models formulated through the solution of the governing equations in the appropriate flow-combustion interaction regime, or through data reduction of available results, low dimensional projection and system identification approaches. Techniques that exploit the predictive capability of these models, or just their overall structure in the design optimal active control techniques for suppressing growing pressure oscillations have been developed and several designs have actually been implemented in bench top and intermediate scale systems with encouraging results. In this talk, I will focus on heat release dynamics models that capture the essence of the