CH_4/Air 대향류 확산 화염의 저신장율에서 진동 불안정성

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Oscillatory Instability at Low Strain Rate of CH_4/Air Counterflow Diffusion Flames

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Key Words : Global Strain Rate(전체화염신장율), Lateral Heat Loss(측면열손실), Lewis Number(루이스수), Oscillatory Instability(진동불안정성)

Abstract : Systematic experiments in CH_4/Air counterflow diffusion flames diluted with He have been undertaken to study the oscillatory instability in which lateral flame size was less than duct diameter and thus lateral heat loss could be remarkable at low global strain rate. The oscillatory instability arises for Lewis numbers greater than unity and occurs near extinction condition. The oscillation is the direct outcome from the advancing and retreating edge flame. The dynamic behaviors of extinction in this configuration can be classified into two; growing and decaying oscillation mode near extinction. As the global strain rate is decreases, the amplitude of the oscillation become larger, caused by increasing lateral heat loss which can be confirmed by the reduction of lateral flame size. Oscillatory edge flame instabilities at low global strain rate are shown to be closely associated with not only Lewis number but also heat loss(radiation, lateral heat loss)

마이크로 튜브 연소기의 연소특성에 대한 수치해석 연구

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A Numerical Study of Combustion Characteristics inside a Micro-tube Combustor

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Key Words: Micro-tube Combustor(마이크로튜브 연소기), Flame Quenching(소염), Flame Stability(화염 안정성), Heat Loss Effect(열손실효과)

Abstract : Unsteady simulations were performed to investigate the flame structure and the dynamic behavior of a premixed flame exposed to the wall heat loss. A 3-step global reaction mechanism was adopted in this study. Simulations were performed for two tube combustors with inner diameters (d_i) of 1mm and 4mm. The material of tube combustor was assumed to be a Silicon Nitride. The heat loss from the outer tube wall was controlled by adjusting the amount of convective and radiative heat loss. A conical premixed flame could be stabilized inside a tube of d_i=4mm. The flame stability inside a tube of d_i=4mm combustor was not much sensitive to the amount of heat loss. In case of a tube of d_i=1mm, an oscillating flame was observed in very low heat loss condition and a flame could not be sustained in realistic heat loss condition.