A Model for Premixed Flame in Closed Tube Effected by Dilute Spary

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ABSTRACT

We propose a thermal theory for the propagation of premixed flame under pressure change with pertubation in energy equation. And the pertubation term can be assumed to simulate the effect of dilute spray on premixed flame.Coupled with equation relating flame burning rate and pressure build up in a closed tube we can model the effect of dilute spray on the propagation of premixed flame in a closed tube. It has long been know that premixed flame with Lewis number smaller than one is stable to one-dimensional disturbances while that with Lewis number bigger than one(Buckmaster and Ludford,1982).And this is reflected in the paper by McGreevy et al.(1992)for premixed flame in closed tube. They found that for flame with $Le>1$(Le represents Lewis number here after) is sensitive to the initial condition and flame with Le1 case two kinds of phenomena might happen,one is the flame propagates faster and faster,then induce homogenous explosion, the other is the flame propagates slower and slower, then extinction occur.From the present study we found that with a perturbation term in the energy equation, the propagation speed of premixed flame with $Le>1$ in a closed tube can be increased. Since the perturbation term in our study was assumed to simulate the effect of dilute spray. Which may indicate a way to improve the combustion in a lean-burn engine by dilute spray.

Keywords: premixed flame ; Lewis number ; spray combustion ; lean-burn engine

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