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Study on the Combustion with Swirl

Osamu KAWAGUCHI*

A study has been conducted on the combustion of swirling gaseous fuel in this paper. Two types of combustion characteristics are recognized; one type is that the high and low speed flashback regions are far apart so that by choosing a proper jet velocity combustion can be maintained throughout wide range of mixture ratio, and the other type is that the region where a stable combustion is maintained is separated into two sections so that in a certain mixture range no stable flame can be obtained.

The swirl intensity does not effect on the blow-out and lift-up points. The flame blows out at the equivalent ratio of $\varphi=0.73$ and lifts up at the same point where ordinary swirlless flame blows out.

These phenomena can be explained by the experimental results of the distribution of the local jet velocity and turbulence intensity.

The turbulent burning velocity at lean mixture calculated from mean jet velocity and shape of the flame front increases as the swirl intensifies. The reason is that the turbulent intensity increases with the swirl intensity. The figure of the ratio of the turbulent burning velocity to the laminar burning velocity becomes greater than four. The fact can be explained only by the effect of small scale turbulence.

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