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The influence of ignition point and concentration gradient on deflagration venting

By Professor Akiko MATSUO

Department of Mechanical Engineering,

Keio University, Yokohama, Japan

This presentation shows the numerical analysis related to hydrogen-air deflagration venting. The aim of this study is to clarify the influence of ignition location and concentration gradient on the peak pressures in the chamber. The numerical analysis target is 27 m^3 cubic chamber which has 2.6 m^2 vent area on the sidewall. The vent opening pressure is set to be gauge 10 kPa. Two different conditions of the hydrogen concentration are assumed, that is, uniform, and gradient. In the uniform case, 20 vol.% and 30 vol.% concentrations are assumed. In the gradient case, the concentration linearly increases from 0 vol.% (at the ground) to 36.5 vol.% and 53.3 vol.% (at the ceiling). The initial total mass of hydrogen in the chamber was the same as the uniform case. Also, three different ignition points are assumed in the uniform case, that is, rear, center, and front of the chamber from the vent. Only center ignition is used for the gradient cases. The deflagrations were initiated by a single ignition source. In the uniform case, some peaks were observed when the ignition point was front and center, while only one peak appeared when the ignition point was rear. The farther from the vent area the ignition point became, the higher the peak pressure got. In the rear ignition case, flame rushes to the vent when vent opens, and a large amount of mixture in the chamber burns, and thus rapid pressure increase occurs. In the other ignition point cases, the amount of burned gas immediately after the venting is smaller than in the rear ignition case, and the remained mixture is burned after the first peak, which leads to second peak. In the gradient case, the highest peak was lower than in the uniform case, though the initial total mass of hydrogen in the chamber was the same as the uniform case. This is because the amount of burned gas is smaller. The burned gas is blown off and flows over 10 m from the vent.