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Influence of equivalence ratio on the mechanism of pressure wave generation during knocking combustion HIROSHI TERASHIMA, The University of Tokyo, MITSUO KOSHI, Yokohama National University — Knocking in spark-assisted engines is known as a severe pressure oscillation mainly caused by hot-spot autoignition in end-gas regions. In this study, knocking combustion of n-heptane/air mixtures modeled in a one-dimensional constant volume reactor is simulated with particular emphasis on the effects of equivalence ratio (0.6 to 2.0) on the mechanism of pressure wave generation. An efficient compressible flow solver with detailed chemical kinetics of n-heptane (373 species and 1071 reactions) is applied. The results demonstrate that the presence of negative temperature coefficient region significantly influence the knocking timing and knocking intensity, i.e., pressure wave amplitude in end-gas regions. The condition with equivalence ratios lower than 1.0 mostly leads to the reduction of the knocking intensity because of slower heat release rates of end-gas autoignition. On the other hand, the results with higher equivalence ratios of 1.2 to 2.0 indicate that a significant peak in the knocking intensity is produced at an equivalence ratio, which varies with initial temperature conditions. The final presentation will address the relationship between the knocking intensity and equivalence ratio with the discussion on detailed physics of pressure wave generation.

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