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Characteristics of Turbulent Premixed Flames under the Pressure Rising Process in a Closed Vessel NAOYA FUKUSHIMA, BASMIL YENERDAG, MASAYASU SHIMURA, MAMORU TANAHASHI, TOSHIO MIYAUCHI, Tokyo Institute of Technology — In a closed vessel such as SI engines, the internal pressure increases due to dilatation during the combustion after the ignition. To clarify quantitative characteristics of turbulent premixed flames under the pressure rising process, direct numerical simulation (DNS) of turbulent premixed flames in a closed vessel at relatively high Reynolds number has been conducted. Detailed kinetic mechanism for hydrogen-air mixtures is used. Because of the local pressure rise, turbulence is enhanced at the unburnt side and flame surface is distorted, which results in increase of the flame surface. Heat release rate of each flame element is augmented since the pressure rise makes flame thickness thin. Under this pressure rising process, the flame thickness, the flame front curvature and the local heat release rate can be scaled by laminar flame thickness and the maximum heat release rate obtained from one dimensional DNS of laminar flame propagation by using averaged temperature in the unburnt region of the vessel as the inlet temperature. The tangential strain rate on the flame front can be scaled by Taylor micro scale averaged in the unburnt side. The local heat release rate is positively correlated with the curvature and the tangential strain. The time evolution of the flame surface area is also investigated quantitatively.

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