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Three-dimensional DNS of turbulent premixed flames in a constant volume vessel NAOYA FUKUSHIMA, AKIHIKO TSUNEMI, MASAYASU SHIMURA, YOUNGSAM SHIM, MAMORU TANAHASHI, TOSHIO MIYAUCHI, Tokyo Institute of Technology — Clarification of flame behaviors in a vessel is of great importance for high efficiency of combustors, especially in SI engines. Direct numerical simulation of turbulent hydrogen-air premixed flames in a constant volume rectangular vessel at relatively high Reynolds number has been conducted by considering detailed kinetic mechanism. At first, flame ignites and propagates from the ignition kernel. When the flame approaches a wall, the flame displacement speed normal to the wall decreases gradually. After the flame impingement on the wall, the flame propagates along the wall and the flame displacement speed parallel to the wall becomes higher than that of freely propagating flames. The flame is also strongly affected by internal pressure rise in the vessel. Since the pressure increase makes flame thickness thin, heat release rate of each flame element is augmented. The local pressure rise due to dilatation also enhances turbulence and finer scale vortices appear, which makes flame surface more complicated and results in increase of the flame surface area.

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