Analysis of detonation wave propagation inside the combustor of a disk-type rotating detonation engine

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This study aims to understand the complex detonation wave propagation inside the combustor of a disk-type rotating detonation engine. Figure 1 (left) shows a cross-sectional view of the engine used in this study. A converging-diverging nozzle is used. Methane and oxygen are used as the fuel and oxidizer, and the minimum thickness of the combustor is 5 mm, considering the detonation cell size. The diameter of the combustor is 100 mm (d_1). The fuel and oxidizer are injected into the combustor through 72 small holes, the oxidizer in the radial direction of the combustor, and the fuel in the horizontal direction of the figure. The size of the holes is 0.5 mm in diameter for both the fuel side and the oxidizer side. As for the part that visualizes the detonation wave inside the combustor, an acrylic plate is used as shown in the figure to make it possible to visualize the inside of the combustor. This visualization makes it possible not only to observe the propagation mode of the detonation wave but also to measure the detonation speed. Figure 1 (right) is a schematic diagram of the engine seen from the nozzle side. The initiator generates a combustion wave that flows from the ignited flame through a thin tube into the engine, making it possible to obtain high energy.

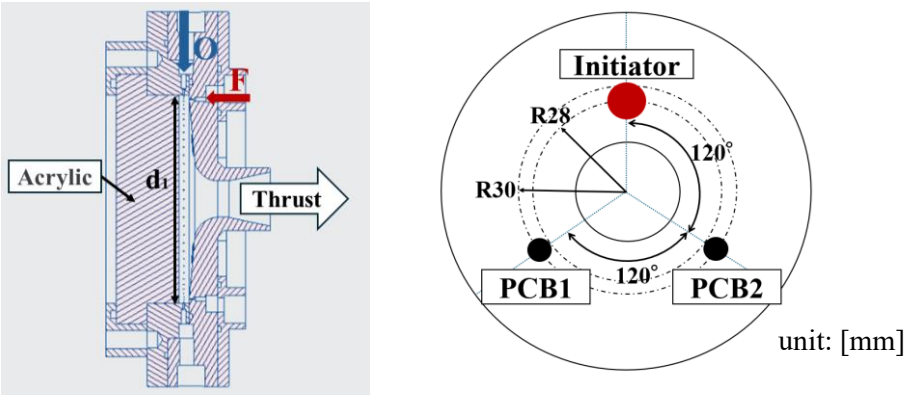

Figure 1: A disk-type rotating detonation engine. Left: Cross-sectional view. Right: Schematic diagram – front view.

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