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ANALYSIS OF OPERATING DIAGRAM FOR KEROSENE / OXYGEN-ENRICHED AIR ROTATING DETONATION COMBUSTORS UNDER LEAN FUEL CONDITION

Abstract

Experiments are performed to investigate the combustion characterization and operating diagram under the lean fuel condition in a laboratory-scale kerosene / oxygen-enriched air rotating detonation combustor (RDC). Pressure signals are obtained at different circumferential and axial positions on the RDC. Equivalence ratios ranging from 0.6 to 1.0 and air mass flow rates ranging from 450 to 700 g/s are used in the experiments. The operating diagram includes unstable detonation (UD), quasi-stable detonation, and stable detonation sub-regions characterized by the combustion mode. The results indicate that the occurrence of UD region is mainly determined by the mixing conditions of the kerosene droplets and oxygen-enriched air. In the quasi-stable detonation region, the UD not completely disappears, and the single/double-detonation wave inversion occurs. In the stable-detonation region, a stable-detonation wave is formed and propagates stably without wave inversion or splitting. The speed and pressure fluctuations of the stable detonation wave are less than 25 % of the mean ones. The present results serve as a guide for the design and practical application of rotating detonation engines.