Paper 33.1

Effect of Strain Rate on NOx Emission in Opposed Impinging Jet Flame Combustor

By
Seongkyu Lim,[1)] Youngbin Yoon,[1)*] Changjin Lee[2)] and In-Seuck Jeung[1)]
[1)]School of Mechanical and Aerospace Engineering, Seoul National University, Seoul, Korea
[2)]Aerospace Engineering, Konkuk University, Seoul, Korea

ABSTRACT

The measurement of velocity and stain rate field has been performed to clarify the mechanism of NOx reduction in an opposed impinging jet combustor using PIV technique. The highly strained velocity field was found in broad regions of the combustor when a smaller diameter orifice of the pre-chambers was used. Also, the ignition delay was observed in the combustor after the ejection of hot jet flames from the pre-chambers. During the ignition delay time, the flow in the combustor became highly turbulent flows. As a result, the intense combustion occurred within decreased combustion time of 10 msec using the smallest diameter orifice; the combustion time was reduced by more than 30% compared with the larger diameter case. Hence, the NOx emission was substantially reduced by a factor of 1/2 while keeping combustion pressure as the same level as that in the conventional combustion devices. The reduction of NOx emission can be attributed to the enhancement of the intermolecular mixing between cold and hot spots in fully turbulent flows. Also, it was found that an appropriate amount of offset in the pre-chamber orifice enhanced the additional reduction of NOx emissions.

Keywords: opposed impinging jet combustion, NOx emission, strain rate, distributed reaction, offset effect