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Numerical and Experimental Investigation of Pulse Combustion for Fabric Drying

Authors : Dan Zhao, Y. W. Sheng

Abstract : The present work considers a convection-driven T-shaped pulse combustion system. Both experimental and numerical investigations are conducted to study the mechanism of pulse combustion and its potential application in fabric drying. To gain insight on flame-acoustic dynamic interaction and pulsating flow characteristics, 3D numerical simulation of the pulse combustion process of a premixed turbulent flame in a Rijke-type combustor is performed. Two parameters are examined: (1) fuel-air ratio, (2) inlet flow velocity. Their effects on triggering pulsating flow and Nusselt number are studied. As each of the parameters is varied, Nusselt number characterizing the heat transfer rate and the heat-driven pulsating flow signature is found to change. The main nonlinearity is identified in the heat fluxes. To validate our numerical findings, a cylindrical T-shaped Rijke-type combustor made of quartz-glass with a Bunsen burner is designed and tested.

Keywords : pulse combustion, fabric drying, heat transfer, combustion oscillations, pressure oscillations
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