Development of a Tubular-Flame Combustor for Thermophotovoltaic Power System

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Abstract

A novel tubular combustor with a metal-oxidedeposited quartz emitter and a reversed tube is developed for application in a small thermophotovoltaic (TPV) power generation system. The combustor employs asymmetrical injections of fuel and swirling air to enhance the fuel/air mixing in a short distance, and the resultant tubular flame provides an optimal thermal energy for the emitter. The tubular flame structures can be categorized into three modes: the double-layer flame, attached-wall flame, and strip flame. Experimental results indicate the laboratory-made metal-oxide-deposited quartz tube has better performance than the conventional silicon carbide emitter. In addition, a reversed tube is implemented with the tubular combustor to redirect the hot product gas for reheating the tube wall. Therefore, the swirling flame is pushed back into the combustion chamber and leads to uniform illumination of the emitter. Consequently, the radiant intensity is increased as compared to that of the emitter without a reversed tube.

Keyword：Mesoscale combustor, metal oxide,