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Investigation of lean combustion stability and pressure drop in porous media burners SADAF SOBHANI, Stanford University, BRET HALEY, DAVID BARTZ, ALZETA Corporation, JARED DUNNMON, Stanford University, JOHN SULLIVAN, ALZETA Corporation, MATTHIAS IHME, Stanford University — The stability and thermal durability of combustion in porous media burners (PMBs) is examined experimentally and computationally. For this, two burner concepts are considered, which consist of different pore topologies, porous materials, and matrix arrangements. Long-term material durability tests at constant and cycled on-off conditions are performed, along with a characterization of combustion stability, pressure drop and pollutant emissions for a range of equivalence ratios and mass flow rates. Experimental thermocouple temperature measurements and pressure drop data are presented and compared to results obtained from one-dimensional volume-averaged simulations. Experimental and model results show reasonable agreement for temperature profiles and pressure drop evaluated using Ergun's equations. Enhanced flame stability is illustrated for burners with Yttria-stabilized Zirconia Alumina upstream and Silicon Carbide in the downstream combustion zone. Results reinforce concepts in PMB design and optimization, and demonstrate the potential of PMBs to overcome technological barriers associated with conventional free-flame combustion technologies.

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