ENHANCEMENT OF HEAT TRANSFER BY THE SURFACE COMBUSTOR-HEATER (SCH) WITH CYCLIC FLOW REVERSAL COMBUSTION (CFRC) OF MIXTURE IN A POROUS MEDIUM

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Based on the new concept of the cyclic flow reversal combustion (CFRC) to the mixture in a packed bed of porous inert medium, successive research on a new surface combustor heater (SCH) embedded with water tube bank was explored. Thermal structure, heat transfer performance and emission characteristics of the new SCH were examined. The heat transfer performance and the emission characteristics were evaluated by comparing them with those of the conventional one way flow combustion (OWFC). Operating parameters such as half-period and equivalence ratio expected to control the performance of the new SCH equipped with the CFRC were clarifled. Results show that the cyclic flow reversal combustion (CFRC) in the SCH with an embedded water tube band was possible despite multiple heat sink and a strong quenching effect. Favorable flame stabilization, extended flammability and a more uniform temperature profile over the tube bank were established.

Preferable heat transfer enhancement and combustion augmentation were obtained with higher thermal efficiency and significantly lower CO emissions at relatively leaner combustion as compared with the conventional OWFC. The CFRC can provide flexibility in the heat transfer performance and the emission characteristics by adjusting the half-period. The thermal efficiency of the CFRC significantly increases as the equivalence ratio decreases. This experimental system offers a two-in-one combustor which can be operated as either the OWFC mode or the CFRC mode, depending on the type of the fuel used. This may be classified as a low-emission, fuel-flexible power system for efficient utilization of energy.