

Effect of ceramic coating in combustion and cogeneration performance of Al₂O₃ porous medium

ABSTRACT

In this work, the effect of SiC-, Ni-, and Cr-based coating on the performance of porous medium burner are evaluated. A dip-coating technique was used to coat SiC, Ni, and Cr powders on a pre-sintered porous Al₂O₃ substrate. The morphological properties of the sintered Al₂O₃ plain substrates and coating layer were observed using a light microscope and scanning electron microscopy. The combustion analyzer has been calibrated and used to measure the emissions during the experiment. Thermoelectric cells were used in the cogeneration system to generate electricity from the porous medium burner. The results show a significant improvement in the maximum surface flame temperature and combustion emissions over the plain substrate. The highest recorded surface flame temperature at flow rate of 0.25 L/min was 750°C for SiC-coated, 741°C for Cr-coated, 739°C for Ni-coated and plain substrate registered a temperature of only 634 °C. An 18% increase in flame temperature was recorded for SiC-coated substrate when compared to the plain substrate. Moreover, the coated substrate reduced the emissions CO, CO_u and NO_x. It was also found that; SiC-coated substrate reported the best overall power output when compared to the plain substrate.

Keyword: Al₂O₃; SiC; Equivalence ratio; Emissions; Permeability