

ERC Seminar
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Radiative cooling in a flameholder for NO_x reduction



Recent experiments at ClearSign Combustion Corp. have revealed dramatic reductions in NO_x emissions using a ceramic honeycomb as a flameholder. A vertical jet of fuel entrains air and mixes with it before entering the honeycomb. The honeycomb is positioned at a distance above the jet nozzle such that the mixed fluid within it is combustible. Combustion occurs within the honeycomb, and heat is transferred from the hot gas to the ceramic walls, which glow red hot. According to a simple physical model, the radiation and thermal conduction transport energy toward the upstream end of the honeycomb, thereby heating the incident cold reactants to maintain combustion. The radiation also transports energy downstream and away from the honeycomb, toward the cold walls of the enclosure. This is desirable in certain applications, such as boilers. As a consequence of this external radiation, the hot combustion products in intimate thermal contact with the walls of the honeycomb are rapidly cooled, yielding very low NO_x emissions. Preliminary experiments with different honeycomb configurations are in accord with this model.