568a Flame Structure in Microcombustion

Adrian D. Armijo, Shaurya Prakash, Mark Shannon, Craig Miesse, and Richard I. Masel

Microcombustors have been proposed as heat sources for a number of portable power devices, but at present the character of combustion on the microscale is poorly understood. The object of this study was to examine the structure of combustion on the micrscale to see how it is different than on the conventional scale.

We find that diffusion flames can exist in spaces as small as 100 microns, but the structure of flames on the scale is quite different than on the conventional scale. Instead of there being continuous flames, the flames break up into individual flame cells over a wide range of conditions. Each cell exhibit a hook like structure, but unlike conventional hook flames the hook points toward the oxidant rather than the fuel side. The structure of the flames is largely unaffected by stoichiometry and the flame stretch, but it is strongly affected by the flow rate and the heat transfer through the walls of the burner. These results suggest that the flame cells are stabilized by a balance between i) the diffusion of reactants into the combustion zone and ii) the transport of heat away from the flame cells via conduction in the combustor wall.