SELF-IGNITION IN GAS VORTICES

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Abstract: Combustible mixtures are shown to self-ignite in a static reactor with tangentional injection of gas at temperatures which are significantly lower than those reported in literature for reactors with central injection. This signifies that the temperature at the reactor center exceeds the reactor temperature and, according to the authors' estimates, the difference can attain 150 K and even more. The effect observed is ascribed to action of centripetal forces that inevitably arise in vortex flows and induce density and temperature stratification in the mixture: the hottest and most quiescent gas with poor heat exchange with surrounding cooler gas layers and reactor walls is concentrated at the reactor center. The pressure rise in the course of gas injection increases the temperature of the gas preheated virtually to the wall temperature by adiabatic compression so that the central domain becomes hotter than the reactor wall. Convection induced by the centripetal forces hinders heat removal from the reacting mixture volume favoring, thereby, its self-ignition.

Keywords: self-ignition; combustible mixtures; gas vortices; tangential injection; centripetal forces; static reactor

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