ABSTRACT

A computer model was developed to examine the chemical kinetic reaction mechanism for the combustion and extinction of premixed methane-air flames.

The model contains 23 chemical species and 73 elementary reaction steps. In the present study the thermal extinction theory was investigated. The radiation heat losses and the residence times of involved species in flames can be simulated with the model. The radiation term is assumed to arise only from gaseous C02 and H20.

Extinction of the flames was simulated using four thermally stable inert gases; carbon dioxide (CO2l, gaseous water (H20), nitrogen (N) and helium (He).

According to the results obtained, the extinguishing efficiency is proportional to the molar heat capacity of the inert gas.

The present simulations show that, when the temperature of the mixture is reduced to a critical level (at which point the production of 0, H and hydroxyl radicals OH is stopped) the mixture extinguishes.

The concentrations of the simulated species and the extinction temperatures were found to comply within reasonable accuracy, with the results obtained from the laboratory measurements.

The importance of the OH-, 0-, and H-radicals in combustion suggests that more effective extinguishants may be found in some substances, which can either stop the production (thermal effects) or catalyze the recombination (chemical inhibition) of these radicals.

Ett BRANDFORSK projekt.