Kinetic Modelling and Experimental Cupburner Results for CF_3I/CO_2 Mixtures

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Abstract

With the prohibition for using Halon 1301 (CF_3Br) in fire suppression systems onboard newly certified aircraft by the European Aviation Safety Agency (EASA), significant research efforts have been undertaken to develop suitable halon replacements with comparable suppression performance that are also eco-friendly with low Ozone Depletion Potential (ODP) and Global Warming Potential (GWP). The fire suppression effectiveness was determined for different mixtures of trifluoroiodomethane (CF_3I) with carbon dioxide (CO_2) that are under evaluation for onboard aircraft fire suppression systems. Through both experimental measurements, as well as flame simulations using detailed chemical kinetics, the extinction concentrations for different CF_3I-to-CO_2 ratios introduced into ambient air were determined using a heptane cupburner. To elucidate important reaction pathways, detailed chemical mechanisms have been developed for modeling methane-, propane- and heptane-air flame inhibition at ambient conditions. Using these chemical kinetic mechanisms, the critical concentration values of CF_3I-CO_2 mixtures in air for extinguishing methane-, propane- and n-heptane counterflow flames were predicted and compared against experimental non-premixed flame extinction data.

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