FLAMMABILITY PROPERTIES OF MIXTURES OF HYDROCARBON BLENDS WITH CF_3I AND C_3HF_7

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ABSTRACT

This talk will cover the flammability envelopes of two hydrocarbon blends, namely natural gas and propane-isobutane based refrigerant, doped with Halon 13001 (CF_3I, trifluoroiodomethane) and HFC-227ea (C_3HF_7, heptafluoropropane). It will explain the experimental technique, review the existing literature, present new data, and conclude with the significance of the results to refrigeration and fire suppression.

Similar suppressant efficiencies are demonstrated between Halon 13001 and Halon 1301 ($CBrF_3$). The peak concentration of Halon 13001 in the natural gas/air mixture is 6.1% compared with 6.0% for Halon 1301. There is a close agreement between the effect of Halon 1301 and Halon 1301 on the upper and lower flammability limits, and both halons substantially mitigate (increase) lower flammability limits even at small concentrations. Likewise, a good agreement was obtained between the limits measured using HFC-227ea. A peak concentration of 11.4% was obtained in this investigation for a natural gas/air mixture, which corresponds identically with 11.4% obtained by Liao et al. [1].

The peak concentration of Halon 13001 needed for inerting of propane-butane/air mixture was 7.3% by volume, which corresponds to 60% in propane-butanehalon mixture to ensure non-flammability. This result is very important if one were to contemplate mixing propane-butane blend with CF_3I to obtain a non-flammable refrigerant. The present data agree well with results from a previous study of Baskin et al. [2], where the peak concentration of Halon 13001 for 70% propane – 30% isobutane refrigerant mixture was found to be 62% from the ASTM E681-85 test method.

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1. C. Liao, N. Saito, **Y.** Saso, and **Y.** Ogawa, "Flammability Limits of Combustible Gases and Vapours Measured by a Tubular Flame Method," *Fire Safety Journal*, 27, pp. 49-68, 1996.
2. E. Baskin, N.D. Smith, **R.** Perry, and M. Tufts, *Flume Suppression and Lubricant Interaction of Hydrocarbon Mixtures for Household Refrigerant/Freezers*, **US** EPA, Air and Energy Research Laboratory, 1996.