

TOXICITY ASSESSMENT OF POLYMERS IN THE MICROSCALE COMBUSTION CALORIMETER

Louise C. Speitel, Richard N. Walters, Richard E. Lyon,
Fire Safety Branch, FAA Technical Center, Atlantic City, NJ

The Microcombustion calorimeter (MCC) has recently been used in a non-standard mode at constant fuel oxygen mass ratios relative to the stoichiometric value, also known as the equivalence ratio, Φ . This MCC- Φ technique generates combustion products under conditions of early stage (over ventilated) to late stage (vitiating) fires using milligram samples in a 15-minute test. MCC- Φ -FTIR is a promising tool for assessing the toxicity of plastics. The MCC- Φ was coupled to an FTIR for a wide range of toxic gases of concern as well as gases that are interferences and that need to be subtracted to get accurate concentrations. A wider mix of combustion gases are generated in vitiated combustion, with more complex FTIR spectra. FTIR methods were developed for this complex mix of spectra to determine gas yields. Over 20 plastics were tested with the MCC- Φ -FTIR technique at Φ s of 0.5, 1 and 2. Toxicities were determined for each material tested. Gases analyzed include CO, CO₂, COCl₂, COF₂, COS, CS₂, HBr, HCN, HCl, HF, NH₃, NO, NO₂, SO₂ as well as interfering gases including CH₄, C₂H₆, C₂H₄, C₂H₂, C₃H₈, and H₂O.