

A BUOYANCY CONTROLLED FIRE CALORIMETER

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A bench scale fire calorimeter on the scale of a cone calorimeter is being developed to measure the energy release rate of materials in a naturally ventilated fire. The device uses radiant heat to force the sample to burn, but the combustion products are delivered to analyzers at the top of an insulated vertical chimney by natural, thermally driven buoyant flow rather than forced convection. The mass flow rate of the combustion products is computed from either the gas temperature and pressure drop across a nozzle at the top of the vertical chimney, or from the gas and chimney temperatures after suitable calibration with methane. Since the combustion products are not diluted with air by forced flow, the measured change in oxygen concentration is relatively large- making this fire calorimeter particularly suitable for the low heat release rate materials used in aircraft cabins. Preliminary tests show that the buoyancy-driven fire calorimeter (BDFC) accurately measures the heat release rate history of a premixed methane calibration burner using the gas and chimney temperature histories alone, because flame radiation is low. For radiant flames of typical materials, oxygen consumption measurements are required for accurate heat release rate histories.