Screening Flame Retardants for Plastics Using Microscale Combustion Calorimetry

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Microscale combustion calorimetry (MCC) was evaluated as a screening test for efficacy of flame-retardant additives in polymers. The MCC method separately reproduces the gas and condensed phase processes of flaming combustion in a non-flaming laboratory test and forces them to completion to obtain intrinsic/material combustion properties. At flame extinction these MCC combustion properties are comparable in magnitude and effect to the extrinsic factors (sample size and orientation), physical behavior (dripping, swelling), and chemical processes (flame inhibition, charring) associated with flame retardancy. Consequently, MCC combustion properties do not, by themselves, determine the flame resistance of plastics. Instead, MCC combustion properties determine the *probability* of flame resistance over a broad range of polymer type and flame retardant chemical composition.