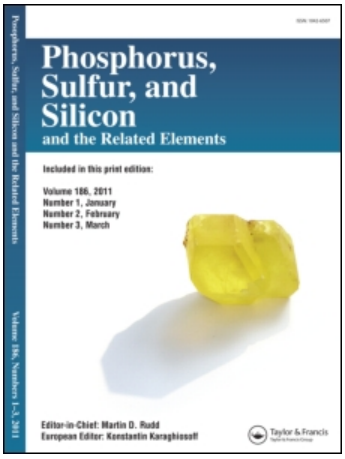

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Phosphonium Bromide Salts as Potential Flame Retardants for Polymeric Materials

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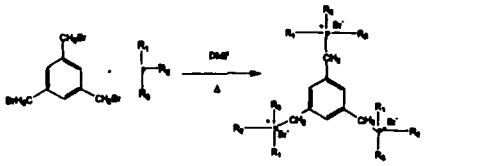
Highly halogenated compounds, particularly multiply brominated aromatics, continue to be effective and widely used flame retardants for a variety of applications. Phosphorus compounds, although somewhat more expensive than the brominated aromatics are effective at lower levels and function in both the solid and gas phase. The combination of both halogen and phosphorus in the same compound can lead to a synergy of action and superior performance as a flame retardant.[1] The preparation of flame retardant compounds containing both halogen and phosphorous requires, first, the synthesis of a halogenated compound that would allow for a reasonable amount of phosphine to be incorporated into the compound and, second, a compound that would also contain a reasonable percentage of halogen after phosphorus incorporation. The halogenated compound selected was 1,3,5-tri(bromomethyl)benzene. 1,3,5-Tri(bromomethyl)benzene is a crystalline, tri-functional compound that is economical to produce and has a relatively high percentage of bromine (67.2%). Treatment of this compound with a variety of phosphines (which were generally available from reaction of the appropriate Grignard or organolithium reagent with phosphorus trichloride) in dimethylformamide, usually at reflux, afforded the corresponding phosphonium bromides in excellent yields. [2] These salts are granular powders which should make excellent



R_1, R_2, R_3	Yield (Percent)	Decomposition Temperature (°C)
Triphenyl	97.3	364
n-Butyldiphenyl	91.9	297
n-Propyldiphenyl	97.6	293
Di-*t*-butylphenyl	87.0	244
Benzyldiphenyl	96.1	344
Methyldiphenyl	95.0	324
Tri-*p*-chlorophenyl	87.7	330
Tri-*t*-butyl	70.2	250

additives. The decomposition behavior of these materials as demonstrated by thermogravimetry suggest that they should be useful in high temperature applications. Several of them have decompostion temperatures in excess of 300 C.

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[1] J. Green, *J. Fire Sci.*, **12**, 257, 388 (1994).

[2] B.A. Howell and K.F. Johnston, Proceedings, Fourth International Conference on Advances in Additives and Modifiers for Polymers and Blends, ECM, Inc., Plymouth, MI, 1995, Ch.21.