

Polyethylene Flame Retarded with Expandable Graphite and a Novel Intumescent Additive

Walter Wilhelm Focke,¹ Hermanus Joachim Kruger,¹ Washington Mhike,¹ Albertus Taute,¹

Albert Roberson,¹ Osei Ofosu²

¹SARChI Chair in Carbon Technology and Materials, Institute of Applied Materials, Department of Chemical Engineering, University of Pretoria, Private Bag X20, Hatfield 0028, South Africa

²CSIR Materials Science and Manufacturing, PO Box 1124, Port Elizabeth 6000, South Africa

Correspondence to: W. W. Focke (E-mail: walter.focke@up.ac.za)

Abstract

A novel intumescent additive was synthesized by neutralizing 3,5-diaminobenzoic acid hydrochloride salt with ammonium dihydrogen phosphate. This compound, which melts at 257°C, decomposes concurrently to release carbon dioxide gas. The flame retardant performance of this compound as a primary fire retardant and in combination with expandable graphite (EG) was evaluated by cone calorimetry. Cone calorimeter results showed that addition of 10 wt % EG alone lowers peak heat release rate (pHRR) of carbon black-pigmented polyethylene from 710 ± 109 to 342 ± 15 kW m⁻², whereas addition of 27 wt % of the novel intumescent lowered it to 400 ± 16 kW m⁻². Combinations of these two additives were able to decrease the pHRR even further. Furthermore, the novel intumescent additive reduced the flame out time from 773 ± 307 to 537 ± 69 s although all other EG containing samples increased it.