Supplementary Material

Synthesis of Flame-retardant Phosphaphenanthrene Derivatives with High Phosphorus Contents

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The TGA curves of compound $a_2$ and $a_4$ in air
The DSC curves of compound a2 and a4 in air

The spectra of the compounds

Fig. 1 The $^1$H NMR spectrum of compound a1
Fig. 2 The $^{13}$C NMR spectrum of compound a1

Fig. 3 The $^{31}$P NMR spectrum of compound a1
Fig. 4 The $^1$H NMR spectrum of compound a2

Fig. 5 The $^{13}$C NMR spectrum of compound a2
Fig. 6 The $^{31}$P NMR spectrum of compound a2

Fig. 7 The $^{31}$P NMR spectrum of compound a3
Fig. 8 The $^{13}$C NMR spectrum of compound a3

Fig. 9 The $^{31}$P NMR spectrum of compound a4
Fig. 10 The $^{13}$C NMR spectrum of compound a4

Fig. 11 The $^{31}$P NMR spectrum of compound a5
Fig. 12 The $^{13}$C NMR spectrum of compound a5

Fig. 13 The $^{31}$P NMR spectrum of compound a6
Fig. 14 The $^{13}$C NMR spectrum of compound a6

Fig. 15 The $^{31}$P NMR spectrum of compound b1
Fig. 16 The HR-MS spectrum of compound b1

Fig. 17 The $^{31}$P NMR spectrum of compound b2
Fig. 18 The HR-MS spectrum of compound b2

Fig. 19 The $^{31}$P NMR spectrum of compound b3
Fig. 20 The HR-MS spectrum of compound b3

Fig. 21 The $^{31}$P NMR spectrum of compound b4
Fig. 22 The HR-MS spectrum of compound b4