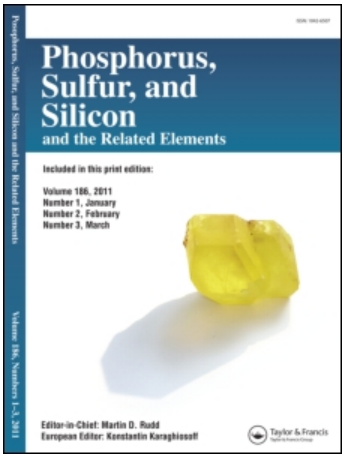


Phosphorus, Sulfur, and Silicon and the Related Elements
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713618290

SYNTHESIS AND POLYMERIZATION OF MULTIFUNCTIONAL CYCLOPHOSPHAZENES

Lianhui Cong[a]; Christopher W. Allen[a]
[a] University of Vermont, Burlington, Vermont, USA

Online publication date: 12 August 2010

To cite this Article Cong, Lianhui and Allen, Christopher W.(2004) 'SYNTHESIS AND POLYMERIZATION OF MULTIFUNCTIONAL CYCLOPHOSPHAZENES', Phosphorus, Sulfur, and Silicon and the Related Elements, 179: 4, 961 — 963
To link to this Article: DOI: 10.1080/10426500490429095
URL: http://dx.doi.org/10.1080/10426500490429095

Phosphorus, Sulfur, and Silicon, 179:961–963, 2004

ISSN: 1042-6507 print / 1563-5325 online
DOI: 10.1080/10426500490429095

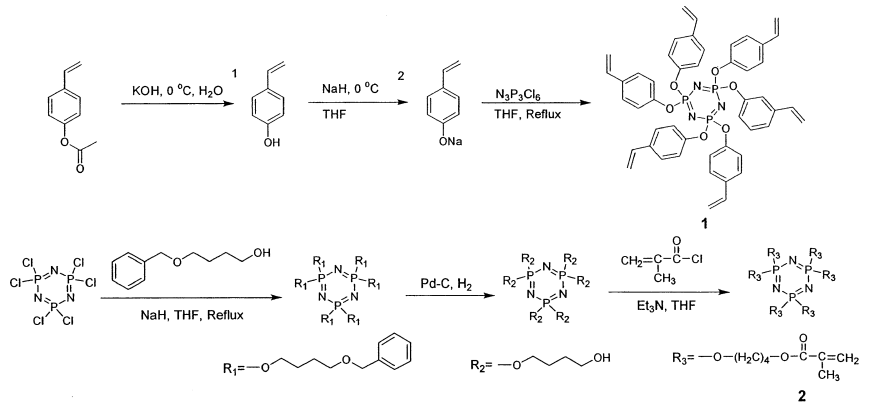
SYNTHESIS AND POLYMERIZATION OF MULTIFUNCTIONAL CYCLOPHOSPHAZENES

Lianhui Cong and Christopher W. Allen
University of Vermont, Burlington, Vermont, USA

(Received September 16, 2003; accepted October 1, 2003)

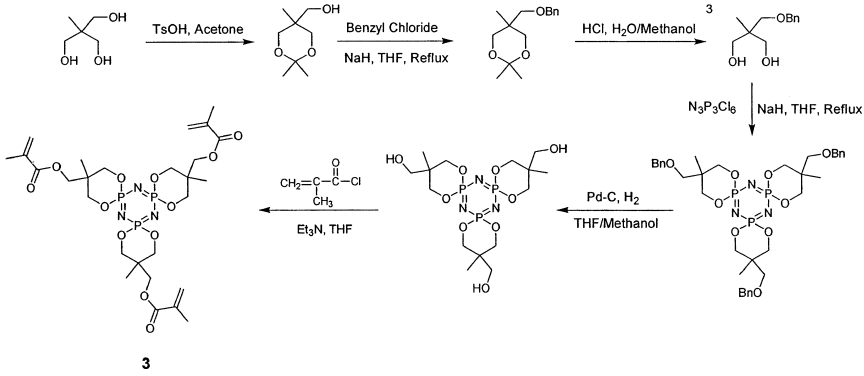
Keywords: Cross linked polymers; cyclophosphazenes; TGA

It has been found that the variety of new and useful cyclotriphosphazene derivatives that are available by nucleophilic displacement of halogens on the phosphazene ring can be expanded dramatically by incorporation of the organofunctional substituents on the phosphazene ring. In our lab, several cyclotriphosphazene derivatives with multiple exocyclic, unsaturated groups were synthesized: $N_3P_3(OC_6H_4CH{=}CH_2)_6$(**1**), $N_3P_3(O(CH_2)_4OC(O)C(CH_3){=}CH_2)_6$(**2**), $N_3P_3(OCH_2C(CH_3)(CH_2OC(O)C(CH_3){=}CH_2)CH_2O)_3$ (**3**). (Scheme 1). The polymerization and thermal stability of the copolymers of the

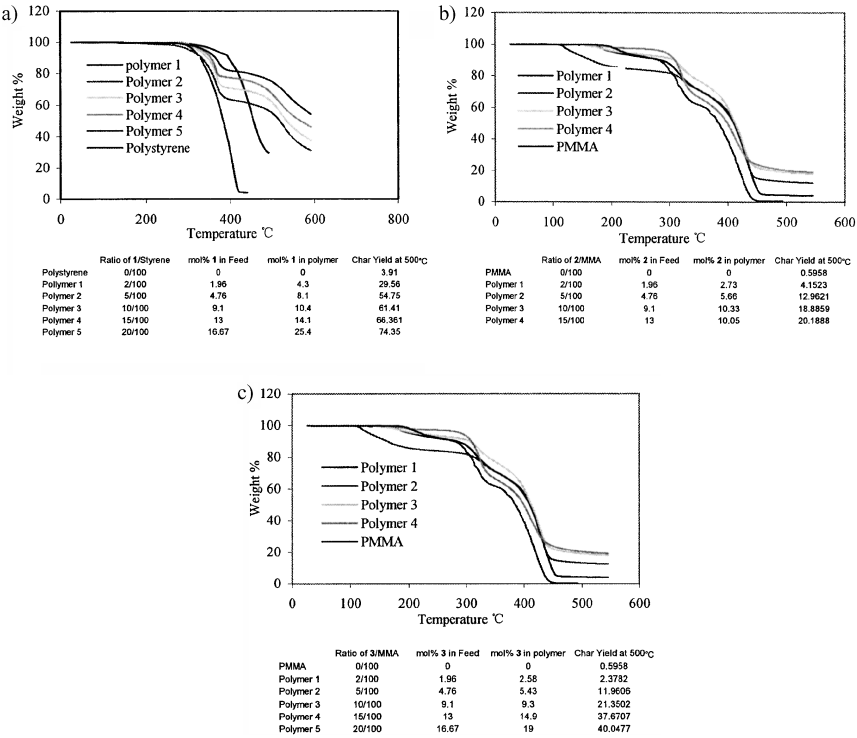


SCHEME 1 *(Continued)*

Address correspondence to Christopher W. Allen, Department of Chemistry, University of Vermont, Cook Physical Science Building, Burlington, VT 05405. E-mail: Christopher.Allen@uvm.edu



SCHEME 1 (Continued)



	Ratio of 1/Styrene	mol% 1 in Feed	mol% 1 in polymer	Char Yield at 500°C
Polystyrene	0/100	0	0	3.91
Polymer 1	2/100	1.96	4.3	29.56
Polymer 2	5/100	4.76	8.1	54.75
Polymer 3	10/100	9.1	10.4	61.41
Polymer 4	15/100	13	14.1	66.361
Polymer 5	20/100	16.67	25.4	74.35

	Ratio of 2/MMA	mol% 2 in Feed	mol% 2 in polymer	Char Yield at 500°C
PMMA	0/100	0	0	0.5958
Polymer 1	2/100	1.96	2.73	4.1523
Polymer 2	5/100	4.76	5.66	12.9621
Polymer 3	10/100	9.1	10.33	18.8859
Polymer 4	15/100	13	10.05	20.1888

	Ratio of 3/MMA	mol% 3 in Feed	mol% 3 in polymer	Char Yield at 500°C
PMMA	0/100	0	0	0.5958
Polymer 1	2/100	1.96	2.58	2.3782
Polymer 2	5/100	4.76	5.43	11.9606
Polymer 3	10/100	9.1	9.3	21.3502
Polymer 4	15/100	13	14.9	37.6707
Polymer 5	20/100	16.67	19	40.0477

FIGURE 1 (a) TGA of copolymers of cyclotriphosphazene 1 and styrene; (b) TGA of copolymers of cyclophosphazene 2 and MMA; and (c) TGA of copolymers of cyclophosphazene and MMA.

multifunctional cyclotriphosphazenes and styrene or methyl methacrylate were investigated. TGA analysis showed the thermal stability of copolymer was greatly enhanced compared with polystyrene and polymethyl methacrylate (Figure 1).

REFERENCES

[1] W. J. Dale and H. E. Hennis, *J. Am. Chem. Soc.*, **80,** 3645 (1958).
[2] D. Hernandez-Rubio and C. W. Allen, *Polymer Preprints*, **4**(2), 1279 (2000).
[3] M. Ouchi, Y. Inoue, K. Wada, et al., *J. Org. Chem.*, **52,** 2420 (1987).