

This article was downloaded by:

On: 29 January 2011

Access details: *Access Details: Free Access*

Publisher *Taylor & Francis*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## 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>

### Substituted Spiro-Phosphazenes

Sula Diefenbach<sup>a</sup>; Udo Engelhardt<sup>a</sup>

<sup>a</sup> Institut für Anorganische und Analytische Chemie for Freien Universität Berlin, Berlin 33

**To cite this Article** Diefenbach, Sula and Engelhardt, Udo(1992) 'Substituted Spiro-Phosphazenes', Phosphorus, Sulfur, and Silicon and the Related Elements, 65: 1, 107 – 109

**To link to this Article:** DOI: 10.1080/10426509208055330

**URL:** <http://dx.doi.org/10.1080/10426509208055330>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

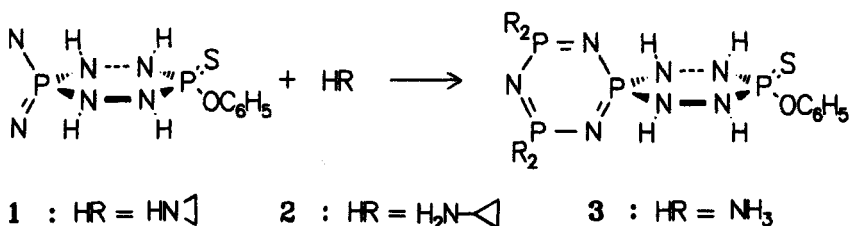
The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

# UBSTITUTED SPIRO-PHOSPHAZENES

ISULA DIEFENBACH and UDO ENGELHARDT  
 Institut für Anorganische und Analytische Chemie  
 der Freien Universität Berlin, Fabeckstr. 34-36,  
 D-1000 Berlin 33

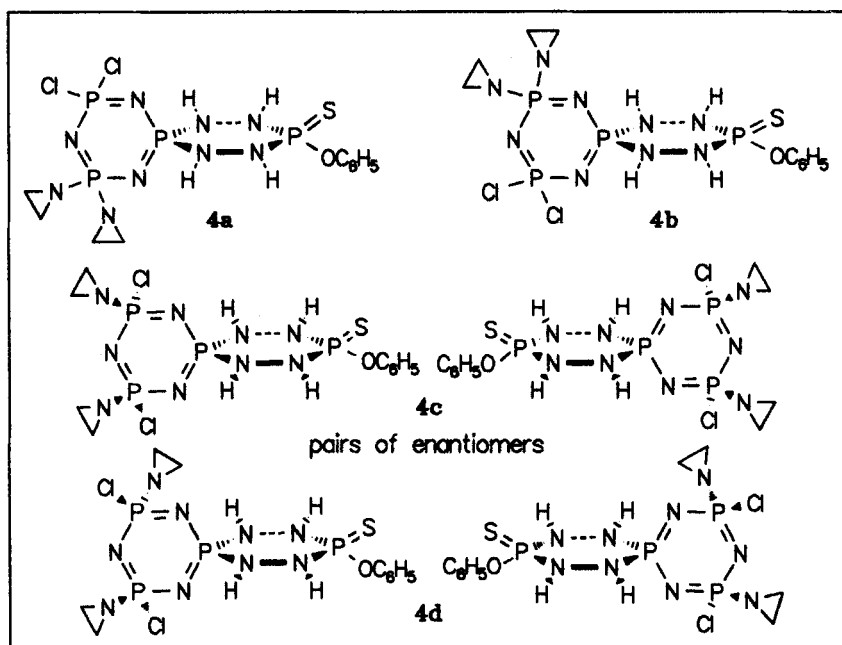
**Abstract** 4,4,6,6 Tetrachloro-6'-phenoxy-6'-thioxo-cyclotriphosphazene-2-spiro-3'-cyclodi[phosphadiazan] reacts with an excess of amines under HCl elimination to give a new type of tetrasubstituted spiro-phosphazenes. Treatment with aziridine in a 2:1 molar ratio leads to a mixture of four isomers of different disubstituted products.

Compounds from hexachlorocyclotriphosphazene and dithiophosphoric acid-O-phenyl-ester [1,2] react with an excess of amines to give the totally substituted compounds 1, 2, 3. The reaction with aziridine leads quantitatively to the stable product 1. Reaction with cyclopropylamine or liquid ammonia gives mixtures of the disubstituted products 2, 3 and small amounts of disubstituted products.

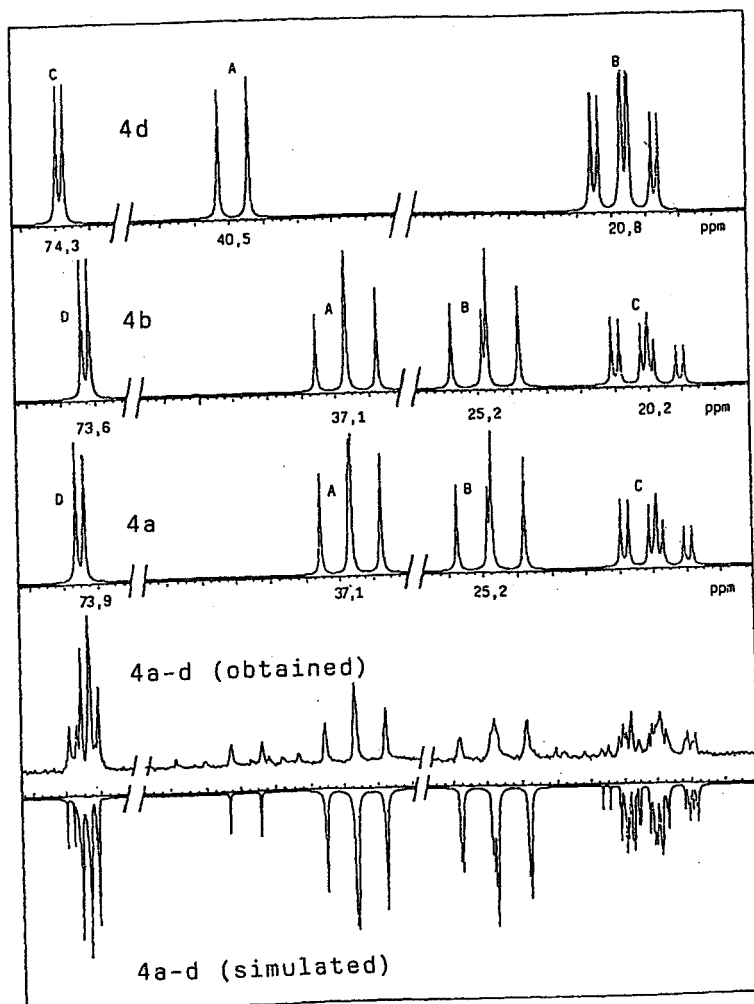


Reaction with aziridine in a 2:1 molar ratio is more complex. A mixture of isomers of different disubstituted products is formed: two disubstituted (Z- and E-)isomers 4a, 4b and two vicinal

disubstituted (cis- and trans-) isomers **4c**, **4d** are found to be present in the reaction mixtures detected by  $^{31}\text{P}$ -NMR (Fig. 1).



Computer simulations of the subspectra (**4a**, **4b**, **4d**) are in good agreement with the obtained spectrum **4a-d**. **4a** and **4b** show spectra of the ABCD-type, the symmetrically substituted compounds **4c** and **4d** of the A<sub>2</sub>BC-type. Because of low concentration of one of the two vicinal disubstituted products **4c** or **4d** one of the subspectra can't be simulated. Probable the formation of the cis-isomer **4c** is hindered because of steric reasons.


 FIGURE 1  $^1\text{H}$ - $^{31}\text{P}$ -NMR-Spectra of 4a-d.

## REFERENCES

- [1] U. Engelhardt, U. Diefenbach; Z. Naturforsch. **44b** (1989) 1545.
- [2] U. Engelhardt, U. Diefenbach, R. Damerius; Z. Naturforsch. **45b** (1990) 457.