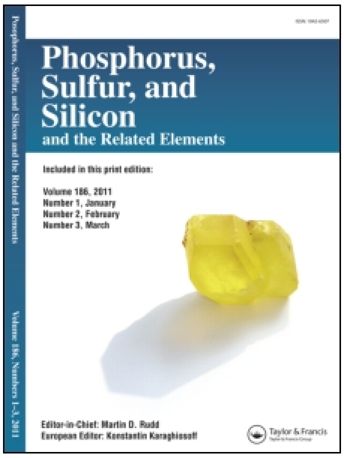


Phosphorus, Sulfur, and Silicon and the Related Elements
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713618290

New Phosphorus - Tellurium Heterocycles in the Quasi - Binary System RP/Te

Stephan Grimm; Konstantin Karaghiosoff; Peter Mayer; Debbie Ross

To cite this Article Grimm, Stephan , Karaghiosoff, Konstantin , Mayer, Peter and Ross, Debbie(2001) 'New Phosphorus - Tellurium Heterocycles in the Quasi - Binary System RP/Te', Phosphorus, Sulfur, and Silicon and the Related Elements, 169: 1, 51 — 54

To link to this Article: DOI: 10.1080/10426500108546588

URL: http://dx.doi.org/10.1080/10426500108546588

Phosphorus, Sulfur and Silicon, 2001, Vol. 169, pp. 51-54
Reprints available directly from the publisher
Photocopying permitted by license only

New Phosphorus – Tellurium Heterocycles in the Quasi – Binary System RP/Te

STEPHAN GRIMM, KONSTANTIN KARAGHIOSOFF,
PETER MAYER and DEBBIE ROSS

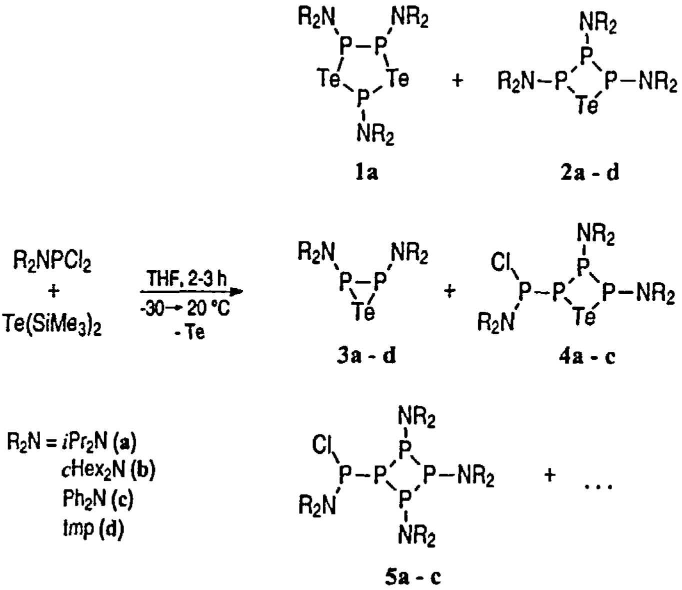
*Department Chemie, Ludwig-Maximilians Universität München,
Butenandtstr. 5–13 (Haus D), D-81377 München, Germany*

Condensation of amino dichlorophosphanes R_2NPCl_2 with Na_2Te or $Te(SiMe_3)_2$ yields the new P,Te-heterocycles **1** – **4** and the phosphino substituted cyclotetraphosphanes **5**. The new compounds are fully characterized by ^{31}P and ^{125}Te NMR spectroscopy. Using a triphenylphosphonium ylidyl dichlorophosphane unexpectedly orange yellow crystals of $(Ph_3P)_2Te$ are isolated, the structure of which is determined by X-ray crystallography.

Keywords: 1,3-ditelluratriphospholanes; telluratriphosphetanes; telluraphosphiranes; triphenylphosphane telluride; ^{31}P and ^{125}Te NMR spectroscopy; X-ray structure determination

Compounds $(RP)_nCh_m$ (Ch = O, S, Se, Te) can be classified between cyclophosphanes $(RP)_n$ and elemental chalcogens. The number of known examples with different n/m ratios and the variety of the structures observed increase rapidly in going from oxygen to sulfur and to selenium derivatives.[1-3] Only a few heterocycles $(RP)_nTe_m$ are reported in the literature, however; all of them have *tert*-butyl substituents at phosphorus.[4]

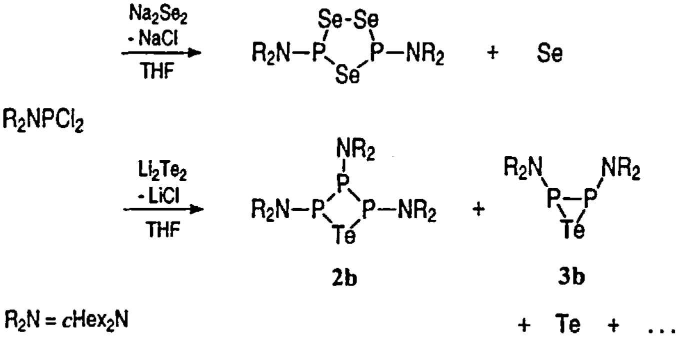
Heterocycles $(RP)_nS_m$ and $(RP)_nSe_m$ are readily prepared either by oxidation of a cyclophosphane $(RP)_n$ with elemental sulfur or selenium or by condensation of dichlorophosphanes $RPCl_2$ with an alkali metal (poly)sulfide or -selenide M_2Ch_x (M = Li, Na, x = 1, 2).[2,3] These syntheses can only in part be applied to the analogous phosphorus tellurium heterocycles. In fact, the cyclophosphane oxidation does not work with elemental tellurium. We find, that the condensation of amino dichlorophosphanes R_2NPCl_2 with Na_2Te or, more conveniently with $Te(SiMe_3)_2$, provides a general route to new aminosubstituted P,Te-heterocycles $(R_2NP)_nTe_m$:



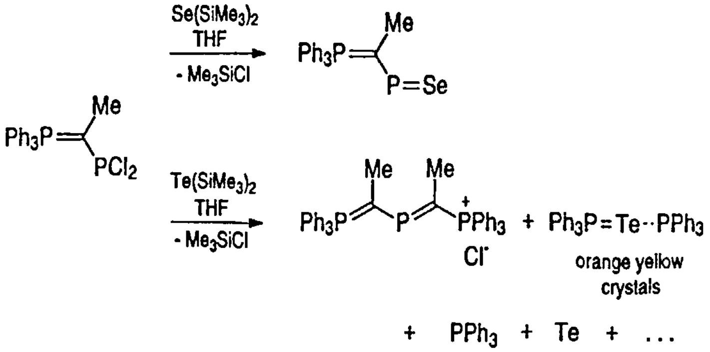
In all cases in addition to condensation also reduction of the dichlorophosphane by the telluride with formation of PP-bonds and elemental tellurium takes place. Thus only heterocycles $(R_2NP)_nTe_m$ with $n > m$ are obtained. Their structures result unambiguously from the ^{31}P- and ^{125}Te NMR spectra.

The 1,3-ditelluratriphospholane **1** is the heterocycle with the highest tellurium content in this system and is observed only for $R_2N = i\text{Pr}_2N$. **1a** spontaneously eliminates tellurium and gives the telluratriphosphetane **2a**. With the bulky tmp substituent the telluradiphosphirane **3d** is the main product. The new phosphino substituted telluratriphosphetanes **4** and tetraphosphetanes **5** are formed in all cases except for R_2N = tmp.

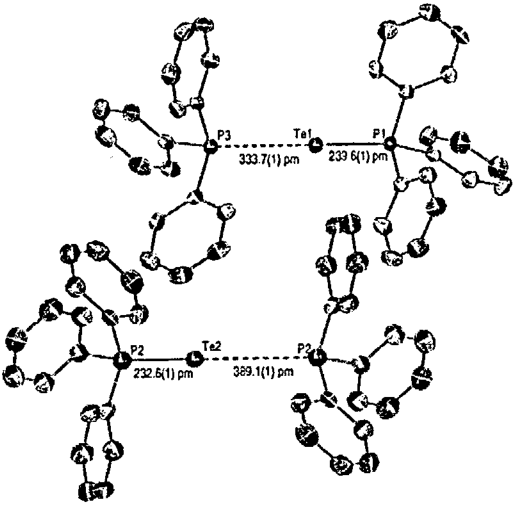
The difference in stability between chalcogen rich heterocycles $(RP)_nSe_m$ and $(RP)_nTe_m$ becomes evident in the condensation of cHex$_2$NPCl$_2$ with Na_2Se_2 and Li_2Te_2. The condensation with Na_2Se_2 yields a stable 1,2,4-triselenadiphospholane [3] ($n < m$), while with Li_2Te_2 only heterocycles with $n > m$ are formed:



Reaction of triphenylphosphonium ylidyl dichlorophosphanes with $Se(SiMe_3)_2$ yields ylide substituted selenoxophosphanes, which are monomeric in solution and in the solid state. [5] The condensation with $Te(SiMe_3)_2$, however, results in the formation of a complex mixture of products. No analogous telluroxophosphane or heterocycles $(RP)_nTe_m$ were detected. Surprisingly, orange yellow crystals of $(Ph_3P)_2Te$, a compound first described by T. Austad et al. [6], could be isolated.



$(Ph_3P)_2Te$ crystallizes in the space group P3 with two independent molecules in the unit cell. Each of the two linear P-Te-P units shows two different PTe distances: the short ones (232.6 and 239.6 pm) can be compared to that in phosphane tellurides (e.g. 136.5 pm in *i*Pr_3PTe), the long ones (337.1 and 389.1 pm) are clearly below the sum of the van der Waals radii of phosphorus and tellurium (410 pm).



References

[1] D. W. Chasar, J. P. Fackler, R. A. Komoroski, W. J. Kroenke, A. M. Mazany, *J. Am. Chem. Soc.* **109**, 5690 (1987).

[2] D. B. Sowerby, in *The Chemistry of Inorganic Homo- and Heterocycles*, Vol. 2, Academic Press, London (1987), Chap. 23.

[3] K. Karaghiosoff, K. Eckstein, R. Motzer, *Phosphorus, Sulfur, Silicon* **93–94**, 185 (1994).

[4] W.-W. Du Mont, T. Severengitz, *Z. Anorg. Allg. Chem.* **619**, 1083 (1993).

[5] G. Jochem, K. Karaghiosoff, S. Plank, S. Dick, A. Schmidpeter, *Chem. Ber.* **128**, 1207 (1995).

[6] T. Austad, T. Rod, K. Ase, J. Songstad, A. H. Norbury, *Acta Chem. Scand.* **27**, 1936 (1973).