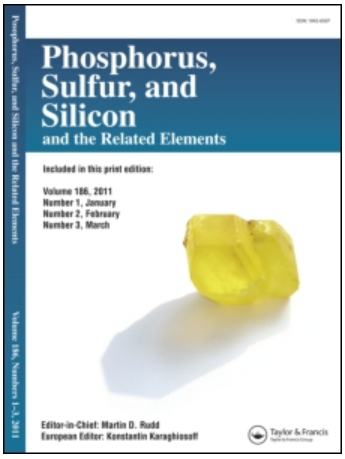

Phosphorus, Sulfur, and Silicon and the Related Elements

Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713618290

Synthesis and Tribofragmentation of Monothio-Phosphates

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To cite this Article Zinke, H. and Schumacher, R.(1990) 'Synthesis and Tribofragmentation of Monothio-Phosphates', Phosphorus, Sulfur, and Silicon and the Related Elements, 51: 1, 365
To link to this Article: DOI: 10.1080/10426509008040894
URL: http://dx.doi.org/10.1080/10426509008040894

Phosphorus, Sulfur, and Silicon, 1990, Vols. 51/52, p. 365
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SYNTHESIS AND TRIBOFRAGMENTATION OF MONOTHIOPHOSPHATES

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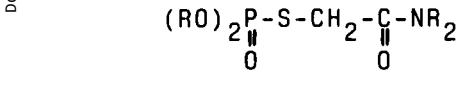
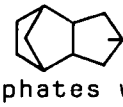
Besides the well-known zinc dithiophosphates (ZDTP) phosphorus and sulfur containing ashless additives are used to improve the lubrication properties of modern engine and hydraulic oils. It is generally accepted that a wear reducing reaction layer is formed by additive tribofragmentation reactions in the friction zone of the metal surface. The composition of those reaction layers and the formation mechanism relative to the used additive is quite unknown. By systematic modification of monothiophosphates the influence of molecule parameters on the wear reducing properties were investigated (1).

By reaction of ammonia-O,O-diisopropylmonothiophosphate with different monochloroacetic acid derivatives the corresponding substituted monothiophosphates were formed (2).



R: iC_3H_7-; R': i-C_4H_9-, nC_6H_{13}-, $C_{13/15}H_{27/31}$-, 

The wear reducing properties of the monothiophosphates were investigated with the SRV-apparatus at the same phosphorus level.

Surface analysis of the wear area by AES shows that by tribofragmentation of the additives phosphorus and sulfur enriched reaction layers are formed which break down at higher temperature if insufficient phosphorus reacts with the metal surface.

(1) R.Schumacher, D.Landolt, H.J.Mathieu, H.Zinke, "Surface Reaction Behaviour of Isogeometrical Phosphorus Compounds", ASLE Trans. 26 (1982) 94 - 101.
(2) EP 0125209 (A2) 3.5.1984, CIBA-GEIGY AG, CH-4002 Basel, Inv. H. Zinke, R.Schumacher.