

## POLYPHOSPHORAMIDO SULPHIDES : A NEW CLASS OF FLAME RETARDANT FOR HTPB

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Polyphosphoramido sulphides were synthesized from aryl phosphoramidic dichlorides and aryl thiophosphoramidic dichlorides with sodium polysulphide in aqueous acetone medium at room temperature. These polymers were characterized by elemental analysis and IR spectroscopy. Their thermal and flammability characteristics were evaluated by thermogravimetry and limiting oxygen index data respectively. These polymers were used as flame retardant for hydroxyl terminated polybutadiene rubber. The flammability and mechanical properties were studied for the cured HTPB rubbers. Higher sulphur content in the structure enhances the LOI and thus the flame retardancy. Polynaphthylthiophosphoramido sulphide emerges as a promising flame retardant amongst four such polymers.

Key words : Polyphosphoramido sulphides, Flame retardant, HTPB, Limiting oxygen index.

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### INTRODUCTION

Simple organic sulphur compounds are commonly used as crosslinking agent/accelerator for vulcanizing rubber. Their polymeric counterparts are rarely known particularly those having flame retardant ability coupled with them. The polymeric flame retardant additives are superior to the conventional non-polymeric ones due to their better resistance to extraction, migration, volatile loss, etc., which contributes to permanent flame retardancy. Phosphorus containing polymers with predominantly aromatic structures generally possess useful properties like high chemical and thermo-oxidative stability with low flammability. The successful study on polyphosphate esters from this

laboratory has led us to undertake a renewed look into this class of polymers (Annakutty and Kishore, 1988; Kannan *et al*, 1989, 1991; Kishore *et al*, 1988, 1990 a, b, 1991). The aliphatic polysulphides are elastic whereas aromatic polysulphides are non-elastic besides being thermally stable (David Eric, 1989). We have synthesized a new class of sulphur, phosphorus, and nitrogen containing flame retardant polymers namely polyphosphoramido sulphides and polythiophosphoramido sulphides. The present investigation deals with the synthesis and their use and characterisation of these polymers as flame retardant in HTPB rubber. The mechanical and flammability properties of the cured HTPB have been studied.

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