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FOREIGN TECHNOLOGY DIVISION

VISCOSITY INDEX IMPROVERS AND THICKENERS
FOR SYNTHETIC LUBRICANTS

by

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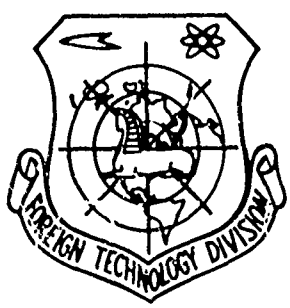

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13. ABSTRACT

The viscosity index of a DI-PH tolyl phosphate lubricant, optionally contg. chlorinated naphthalene as a high pressure additive or corrosion inhibitor, is increased (e.g., from 16 to 108) by the addn. of 5-15% poly(propylene adipate) (mol. wt. 5000) or poly(ethylene sebacate) (mol. wt. 3000), polyesters which have better shear stability than polymethacrylates used as viscosity index improvers. [AA1202043]

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VISCOSITY INDEX IMPROVERS AND THICKENERS FOR SYNTHETIC LUBRICANTS

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This invention concerns viscosity index improvers and thickeners for synthetic lubricants, particularly for phosphoric acid esters or mixtures of phosphoric acid esters with chlorinated aromatic compounds.

It is known that high-molecular-weight polyacrylate or polymethacrylate esters should be used for improvement of the viscosity-temperature behavior and/or for thickening of lubricants based on mineral or synthetic oils. In order to attain a good improvement of the viscosity index, the compounds used must be of very high molecular weight. This simultaneously increases the thickening effect of these additives.

Complex esters or polyesters of the general formula

$$R\text{-}OOC\text{-}(CH_2)_x\text{-}COO\text{-}(CH_2)_y\text{-}OOC\text{-}(CH_2)_x\text{-}COO\text{-}R$$

and

$$R'\text{-}COO\text{-}(CH_2)_y\text{-}OOC\text{-}(CH_2)_x\text{-}COO\text{-}(CH_2)_y\text{-}COO\text{-}R'$$

in which R indicates the alkyl residue of an alcohol, R' the alkyl residue of a monocarboxylic acid, $-(CH_2)-_x$ a component of a dicarboxylic acid, and $-(CH_2)-_y$ a component of a glycol are used as components of mixtures for synthetic oils.

The polyacrylate and polymethacrylate are quite effective as viscosity index improvers if they have sufficiently high molecular weight, but they often cause too much thickening. A greater disadvantage is their low shear stability, which becomes even worse with increasing molecular weight. The aging stability is also insufficient at high temperatures. The production costs for these esters are very high.

In comparison, the complex ester types mentioned are very stable to shear, but have only a slight effect in improving the viscosity index.

This invention is based on the problem of developing compounds which improve the viscosity-temperature behavior of synthetic oils, especially of phosphoric acid esters and their mixtures with chlorinated aromatics, increase the viscosity of such synthetic oils, and show good shear stability.

It was found that linear polyesters of the general formula

$$RO-\left[-(Y)_m-OOC(X)_nCOO-\right]_Z(Y)_m-CR$$

or

$$R'-OOC(X)_nCOO-\left[-(Y)_m-OOC(X)_n-COO-\right]_ZR'$$

or

$$R'-\left[-OOC(X)_nCOO-(Y)_m-\right]_ZOR\ ,$$

in which R represents hydrogen or an alkyl residue; R' an alkyl, alkenyl, cycloalkyl, or aryl residue; Y an alkyl, alkenyl, or cycloaklyl residue of a diol; X an alkyl, alkenyl, cycloalkyl or aryl residue of a dicarboxylic acid; n an integer from 1 to 12; m an integer from 1 to 16; and Z an integer

from 4 to 400, considerably improve the viscosity index behavior of synthetic oils and increase the viscosity of such oils, in spite of their relatively low molecular weights.

Linear polyesters with a molecular weight in the range from 500 to 10,000 are prepared according to well-known methods by condensation of the appropriate dicarboxylic acid with a diol. Both the dicarboxylic acid and the bifunctional alcohol can be used in excess. With an excess of carboxylic acid, the resulting carboxyl groups are to be esterified completely with monoalcohols having a chain length of $C_{1 \text{ to } 20}$. With an excess of the diol, the resulting hydroxyl groups are partially or completely esterified.

The polyesters described are added to the synthetic oils mentioned in amounts of 1 to 20 parts by weight, and preferably from 5 to 15 parts by weight. They show great shear stability. For improvement of other oil properties, the polyesters described in this patent can be used in combination with other additives such as high pressure additives or corrosion inhibitors. They are particularly suited for synthetic oils based on phosphoric acid esters and their mixtures with chlorinated aromatics, but are also suitable for mixtures of these compounds with other synthetic oils such as ester oils or polyalkyleneglycols.

With the linear polyesters, compounds are found which considerably improve the viscosity-temperature behavior of synthetic oils. Because of their good shear stability in comparison to known viscosity index improvers, they do not lose this action even after long periods of use. Their production costs are low in comparison to known viscosity index improvers.

In the following, the invention will be explained in more detail through specific examples.

Example 1:

95 parts by weight of a technical diphenylcresyl phosphate with a viscosity of 11.8 centistokes at 50°C were mixed with 5 parts by weight of a polypropylene adipate with a mean molecular weight of 5,000. The viscosity of the mixture increased to 19.2 centistokes at 50°C. The viscosity index improved from 16 to 108.

Example 2:

A mixture consisting of 90 parts by weight of diphenylcresyl phosphate and 10 parts by weight of a chloronaphthalene was mixed with 8 parts by weight of a polyester of sebacic acid and ethylene glycol, having a mean molecular weight of 3,000. The viscosity at 50°C increased from 11.0 to 17.1 centistokes. The viscosity index increased from -4 to 83.

Both compositions were tested for shear stability by the ultrasonic method. The viscosity and viscosity index remained unchanged, in contrast to oils mixed with polymethacrylate.

PATENT CLAIMS:

1. Use of linear polyesters with a molecular weight of 500 to 10,000 and the general formula

$$RO-\left[-(Y)_m-OOC(X)_nCOO-\right]_z(Y)_m-CR$$

or

$$R'-OOC(X)_nCOO-\left[-(Y)_m-OOC(X)_n-COO-\right]_zR'$$

or

$$R'\left[OOC(X)_nCOO-(Y)_m\right]_zOR\ ,$$

in which R represents hydrogen or an alkyl residue; R' an alkyl, alkenyl, cycloalkyl, or aryl residue; Y an alkyl, alkenyl, or cycloalkyl residue of a diol; X an alkyl, alkenyl, cycloalkyl, or aryl residue of a dicarboxylic acid; n an integer from 1 to 12; m an integer from 1 to 16; and Z an integer from 4 to 400, as viscosity index improvers and/or thickeners for synthetic lubricants such as phosphoric acid esters and mixtures of phosphoric acid esters with chloroaromatics.

2. Use of linear polyesters according to claim 1 in concentrations of 1 to 20 parts by weight, and preferably from 5 to 15 parts by weight, calculated on the basis of the total mixture.

3. Use of linear polyesters according to claim 1 and 2 in combination with other additives such as high pressure additives or corrosion inhibitors.