nitrogen content is high, i.e., insofar as the number of nitrogen atoms of the polyamine is larger than the number of succinic anhydride groups substituted by a polyisobutenyl group. However, the higher the basic nitrogen content of these dispersants, the more they favor the attack of the fluoroelastomer seal used in modern engines, because the basic nitrogen tends to reach with the acidic hydrogen atoms of this type of seal, and this attack results in the formation of cracks in the elastomer surface and the loss of other physical properties sought in this type of material. The '247 patent further discloses that by using lubricating oil compositions containing a dispersant of mono-succinimide or bis-succinimide type, post-treated or not, in combination with a borated glycerol ester, one obtains a composition compatible with fluorocarbon elastomers.

[0010] Accordingly, it would be desirable to develop lubricating oil compositions which exhibit improved fluorocarbon elastomer seal compatibility.

SUMMARY OF THE DISCLOSURE~~INVENTION~~

[0011] In accordance with one embodiment of the present disclosure~~invention~~, there is provided a method for improving compatibility of a fluorocarbon elastomer seal with a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; and (b) one or more dispersants containing one or more basic nitrogen atoms, the method comprising adding to the lubricating oil composition an effective amount of one or more fluorocarbon elastomer compatibility improving agents comprising one or more non-halogen-containing oil-soluble titanium complexes comprising at least one ligand selected from the group consisting of (i) an anion of a saturated carboxylic acid, (ii) an anion of an α-, β- or γ-hydroxycarbonyl compound; (iii) an anion of an α-, β- or γ-hydroxycarboxylic acid, amide, or ester; (iv) an anion of an α-, β- or γ-aminocarboxylic acid; and (v) an anion of an α-, β- or γ-keto acid.

[0011a] In one aspect, there is provided a method for improving compatibility of a fluorocarbon elastomer seal with a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; and (b) one or more dispersants containing one or more basic nitrogen atoms, the method comprising adding to the lubricating oil composition an effective amount of one or more fluorocarbon elastomer compatibility improving agents comprising one or more non-halogen-containing oil-soluble titanium complexes comprising at least one ligand selected from the group consisting of (i) an anion of a saturated carboxylic acid, (ii) an anion of an α-, β- or γ-hydroxycarbonyl compound; (iii) an anion of an α-, β- or γ-hydroxycarboxylic acid, amide, or ester; (iv) an anion of an α-, β- or γ-aminocarboxylic acid; and (v) an anion of an α-, β- or γ-keto acid, wherein the effective amount of one or more fluorocarbon elastomer compatibility improving agents is from 0.10 to 2.5 wt. %, based on the total weight of the lubricating oil composition.

[0012] In accordance with a second embodiment of the present disclosure~~invention~~, there is provided a method for maintaining or improving compatibility of a fluorocarbon elastomer seal with a lubricating oil composition in an internal combustion engine which comprises operating the engine with a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; (b) one or more dispersants containing one or more basic nitrogen atoms; and (c) an effective amount of one or more fluorocarbon elastomer compatibility improving agents comprising one or more non-halogen-containing oil-soluble titanium complexes comprising at least one ligand selected from the group consisting of (i) an anion of a saturated carboxylic acid, (ii) an anion of an α-, β- or γ-hydroxycarbonyl compound; (iii) an anion of an α-, β- or γ-hydroxycarboxylic acid, amide, or ester; (iv) an anion of an α-, β- or γ-aminocarboxylic acid; and (v) an anion of an α-, β- or γ-keto acid.

[0013] The method of the present disclosure~~invention~~ advantageously improves the compatibility of a fluorocarbon elastomer seal with a lubricating oil composition comprising (a) a major amount of a base oil of lubricating viscosity; and (b) one or more dispersants containing one or more basic nitrogen atoms, by adding to the lubricating oil composition an effective amount of one or more fluorocarbon elastomer compatibility improving agents one or more non-halogen-containing oil-soluble titanium complexes comprising at least one ligand selected from the group consisting of (i) an anion of a saturated carboxylic acid, (ii) an anion of an α-, β- or γ-hydroxycarbonyl compound; (iii) an anion of an α-, β- or γ-hydroxycarboxylic acid, amide, or ester; (iv) an anion of an α-, β- or γ-aminocarboxylic acid; and (v) an anion of an α-, β- or γ-keto acid.