# LUBRICANT ADDITIVES AND LUBRICANT COMPOSITIONS HAVING IMPROVED FRICTIONAL CHARACTERISTICS

## TECHNICAL FIELD

**[0001]** The disclosure relates to lubricant additives and lubricant compositions that provide improved frictional characteristics for engine oil and gear applications. In particular, the disclosure relates to a unique combination of metal-containing phosphorus antiwear agents and polyols that provides synergistically improved boundary friction characteristics to a lubricant composition.

## BACKGROUND AND SUMMARY

**[0002]** In recent years, there has been growing concern to produce energy-efficient lubricated components. Moreover, modern engine oil specifications require lubricants to demonstrate fuel efficiency in standardized engine tests. The thickness and frictional characteristics of lubricant films are known to affect the fuel economy properties of oils.

**[0003]** When rubbing surfaces in a machine (engine, gear system or transmission) come into contact, a frictional force exists that retards the motion of the surfaces. This frictional force, called boundary friction, reduces the efficiency of the machine. Boundary friction coefficients may be measured for a lubricant composition using the high frequency reciprocating rig (HFRR). The boundary friction measured in the HFRR is known to be related to fuel efficiency in vehicles. The ability of the lubricant composition to reduce boundary layer friction is reflected by the determined boundary lubrication regime coefficient of friction (COF). A lower value is indicative of lower friction and thus improved fuel economy.

**[0003a]** In one aspect of the present disclosure, there is provided a lubricant additive for reducing a boundary friction coefficient of a lubricant composition, comprising a synergistic mixture of:

a) a metal-containing phosphorus antiwear compound derived from at least one secondary alcohol in an amount sufficient to provide the lubricant composition with from about 200 to about 1000 ppm by weight phosphorus, and

b) a polyol derived from a diol and a mono-ol having a diol to mono-ol molar ratio ranging from about 0.3:1 to about 2.0:1, wherein the diol contains from 6 to 36 carbon atoms and the mono-ol contains from 12 to 16 carbon atoms, wherein the polyol is present in the lubricant additive in an amount sufficient to provide a synergistic reduction in the boundary friction coefficient of the lubricant composition in combination with component (a).

**[0003b]** In another aspect of the present disclosure, there is provided a lubricant composition comprising a base oil and from about 2 wt.% to about 12 wt. % of the lubricant additive as defined herein.

**[0003c]** In yet another aspect of the present disclosure, there is provided a method for synergistically reducing a boundary friction coefficient of a lubricant composition, comprising combining a base oil of lubricating viscosity having a first boundary friction coefficient with a lubricant additive comprising:

a) a metal-containing phosphorus antiwear compound derived from at least one secondary alcohol in an amount sufficient to provide the lubricant composition with from about 200 to about 1000 ppm by weight phosphorus; and

b) a polyol derived from a diol and a mono-ol having a diol to mono-ol molar ratio ranging from about 0.3:1 to about 2.0:1, wherein the diol contains from 6 to 36 carbon atoms and the mono-ol contains from 12 to 16 carbon atoms, wherein the polyol is present in the lubricant additive in combination with component (a) in an amount sufficient to provide a second boundary friction coefficient of the lubricant composition that is less than the first boundary friction coefficient of the lubricant composition,

wherein the lubricant composition containing the additive comprises from about 0.2 to about 2.0 wt.% of component (b).

**[0003d]** In a further aspect of the present disclosure, there is provided a method for improving the fuel economy of a vehicle comprising lubricating the vehicle with a lubricant composition comprising:

a) a base oil of lubricating viscosity;

b) a metal-containing phosphorus antiwear compound derived from at least one secondary alcohol in an amount sufficient to provide the lubricant composition with from about 200 to about 1000 ppm by weight phosphorus; and

c) a polyol derived from a diol and a mono-ol having a diol to mono-ol molar ratio ranging from about 0.3:1 to about 2.0:1, wherein the diol contains from 6 to 36 carbon atoms and the mono-ol contains from 12 to 16 carbon atoms, wherein the polyol is present in the lubricant composition in combination with component (b) in an amount sufficient to provide a boundary friction coefficient of the lubricant composition that is synergistically less than a boundary friction coefficient of the lubricant composition containing only one of component (b) or component (c) ,

wherein the lubricant composition containing the additive comprises from about 0.2 to about 2.0 wt.% of component (b).

**[0004]** The present disclosure relates to a lubricant additive, method for reducing a boundary friction coefficient of a lubricant composition, and method for improving fuel economy. The additive includes a synergistic mixture of a) a metal-containing phosphorus antiwear compound derived from at least one secondary alcohol in an amount sufficient to provide the lubricant composition with from about 200 to about 1000 ppm by weight phosphorus, and b) a polyol derived from a diol and a mono-ol having a diol to mono-ol molar ratio ranging from about 0.3:1 to about 2.0:1, wherein the diol contains from 6 to 36 carbon