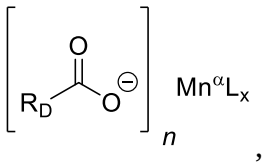
CLAIMS

What is claimed is:

1. A method for preventing or reducing low speed pre-ignition in a direct injected, boosted, spark ignited internal combustion engine, said method comprising the step of lubricating the crankcase of the engine with a lubricating oil composition comprising from 25 to 3000 ppm of metal from at least one manganese-containing compound, based on the total weight of the lubricating oil composition, wherein the at least one manganese-containing compound has the following formula:



,

wherein α is +2 or +3 oxidation state, R_D is a branched, saturated hydrocarbon moiety having from 1 to 30 carbon atoms, , *n* is an integer from 0 to 3, L is absent or a ligand that saturates the coordination sphere of manganese, and *x* is an integer from 0 to 6.

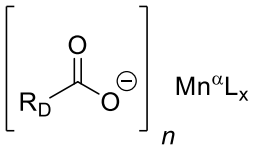
2. The method of claim 1, wherein the engine is operated under a load with a break mean effective pressure (BMEP) of from 12 to 30 bars.
3. The method of claim 1, wherein the engine is operated at speeds between 500 and 3,000 rpm.
4. The method of claim 1, wherein the lubricating oil further comprises a detergent selected from calcium detergents, magnesium detergents, sodium detergents, lithium detergents, and potassium detergents.
5. The method of claim 4, wherein the detergent is a carboxylate, salicylate, phenate, or sulfonate detergent.
6. The method of claim 1, wherein the lubricating oil further comprises a molybdenum containing compound.

7. The method of claim 1, wherein the lubricant composition further comprises at least one other additive selected from an ashless dispersant, an ashless antioxidant, a phosphorus- containing anti-wear additive, a friction modifier, and a polymeric viscosity modifier.

8. The method of claim 1, wherein the engine is fueled with a liquid hydrocarbon fuel, a liquid nonhydrocarbon fuel, or mixtures thereof.

9. The method of claim 1, wherein the engine is fueled by natural gas, liquefied petroleum gas (LPG), compressed natural gas (CNG), or mixtures thereof.

10. Use of at least one manganese-containing compound in a lubricating engine oil composition for preventing or reducing low speed pre-ignition in a direct injected, boosted, spark ignited internal combustion engine, wherein the at least one manganese-containing compound has the following formula

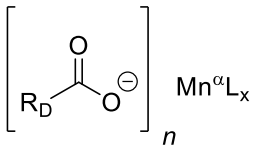


,

wherein α is +2 or +3 oxidation state, R_D is a branched, saturated hydrocarbon moiety having from 1 to 30 carbon atoms, *n* is an integer from 0 to 3, L is absent or a ligand that saturates the coordination sphere of manganese, and *x* is an integer from 0 to 6.

11. Use of claim 10, wherein the at least one manganese-containing compound is present in from about 25 to about 3000 ppm of metal from the at least one manganese-containing compound, based on the total weight of the lubricating oil composition.

12. A lubricating engine oil composition for use in a down-sized boosted engine comprising a lubricating oil base stock as a major component; and at least one manganese-containing compound, as a minor component; wherein the at least one manganese-containing compound has the following formula



,

wherein α is +2 or +3 oxidation state, R_D is a branched, saturated hydrocarbon moiety having from 1 to 30 carbon atoms, *n* is an integer from 0 to 3, L is absent or a ligand that saturates the coordination sphere of manganese, and *x* is an integer from 0 to 6 and wherein the downsized engine ranges from 0.5 liters to 3.6 liters.