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 ~~about~~ 25 to ~~about~~ 3000 ppm of metal from at least one cobalt-containing compound, based on the total weight of the lubricating oil composition;

   wherein, when the cobalt compound is a cobalt carboxylate, the carboxylate is branched and saturated.

2. The method of claim 1, wherein the engine is operated under a load with a break mean effective pressure (BMEP) of from ~~about~~ 12 to ~~about~~ 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 cobalt-containing compound is a cobalt alkoxide compound, colloidal dispersion of a cobalt salt, cobalt amido compound, cobalt acetylacetonate compound, cobalt branched and saturated carboxylate compound, cobalt salicylate compound, cobalt arylsulfonate compound, cobalt sulfurized or unsulfurized phenate compound, bis(cyclopentadienyl)cobalt compound, dithiocarbamato cobalt complex, dithiophosphato cobalt complex, salen cobalt complex, phosphate ester, phospinate, or phosphinite cobalt complex, pyridyl, polypyridyl, quinolinolato, or isoquinolato cobalt complex, glyoximato cobalt complex, alkyldiamino cobalt complex, azamacrocyclic cobalt complex, cobalt alkylsufonate compound, cobalt basic nitrogen succinimide complex, cobalt sulfanyl alkanoate, or cobalt colloidal suspension.

5. 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.

6. The method of claim 5, wherein the detergent is a carboxylate, salicylate, phenate, or sulfonate detergent.

7. The method of claim 1, wherein the lubricating oil further comprises a molybdenum containing compound.

8. 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.

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

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

11. Use of at least one cobalt-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 when the cobalt compound is a cobalt carboxylate, the carboxylate is branched and saturated.

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

~~13. 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 cobalt-containing compound, as a minor component; wherein the downsized engine ranges~~

~~from 0.5 liters to 3.6 liters; wherein when the cobalt compound is a cobalt carboxylate, the carboxylate is branched and saturated.~~

~~14.~~13. A method for improving deposit control performance while at the same time 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 at least one cobalt containing compound; wherein, when the cobalt compound is a cobalt carboxylate, the carboxylate is branched and saturated.

~~15.~~14. The method of claim ~~14~~13, wherein the cobalt compound is a cobalt branched and saturated carboxylate.