CLAIMS:

What is claimed is:

1. A lubricant composition comprising an oil and at least one long chain branched ethylene copolymer having;
    a. a Mw/Mn from 2.0 to 6.5;
    b. a Mw(LS) from 30,000 to 300,000 g/mol;
    c. a branching index (g'_{vis}) of from 0.5 to 0.97; and
    d. an ethylene content of 40 wt% to 75 wt%.
2. The composition of claim 1, wherein the long chain branched ethylene copolymer has one or more of:
    (a) a Mw(LS)/Mn(DRI) from 2.0 to 6.5;
    (b) a Mw(LS) from 30,000 to 300,000 g/mol;
    (c) a g'_{vis} of from 0.5 to 0.97;
    (d) an ethylene content of 40 wt% to 75 wt%; and
    (e) a shear stability index (30 cycles) of from 1% to 60%.
3. The composition of claim 1, where the ethylene copolymer comprises a blend of a first copolymer and a second copolymer, wherein at least one of the first copolymer and second copolymer is a long chain branched ethylene copolymer and the second copolymer has an ethylene content less than the ethylene content of the first copolymer.
4. The composition of claim 1 or 2, where the long chain branched ethylene copolymer is an ethylene/propylene copolymer
5. The composition of claim 1 or 2, wherein the lubricant composition has an aluminum content of 1 ppm or less.
6. The composition of claim 1 or 2, wherein the copolymer has an ethylene content of 43 wt% to 73 wt%.
7. The composition of claim 1 or 2 wherein the long chain branched ethylene copolymer has a shear thinning ratio greater than 0.8572*EXP(2E-05*w) where w is the Mw(LS) from light scattering GPC-3D.
8. The composition of claim 1 or 2, which has a kinematic viscosity at 100ºC of from 3 cSt to cSt.

9. The composition of claim 1 or 2, which has a kinematic viscosity at 100ºC of from 10 cSt to 15 cSt.
10. The composition of claim 1 or 2 has a shear stability index (30 cycles) of from 10% to 50%.
11. The composition of claim 1 or 2, which has a shear stability index (30 cycles) of from 15% to 40%.
12. The composition of claim 1 or 2, which has a thickening efficiency of from 1 to 4.
13. The composition of claim 1 or 2 has a thickening efficiency of from 1.5 to 3.5.
14. The composition of claim 1 or 2, wherein the long chain branched ethylene copolymer has a g'_{vis} of from 0.55 to 0.85.
15. The composition of claim 1 or 2, which comprises 0.01 wt% to 12 wt% of the long chain branched ethylene copolymer.
16. The composition of claim 1 or 2, which comprises 0.01 wt% to 3 wt% of the copolymer.
17. The composition of claim 1 or 2, wherein the oil comprises a hydrocarbon, polyalphaolefin, alkyl esters of dicarboxylic acids, polyglycols, alcohols, polybutenes, alkylbenzenes, organic esters of phosphoric acids, polysilicone oils, or combinations thereof.
18. The lubricant composition according to claim 1 or 2 further comprising at least one of a dispersant, a detergent, an antioxidant, an oiliness improver, a pour point depressant, a friction modifier, a wear modifier, an extreme pressure additive, a defoamer, a deemulsifier, or a corrosion inhibitor.
19. The composition of claim 1 or 2, which has a high temperature, high shear (HTHS) viscosity of 4.0 cP or less.
20. The composition of claim 1 or 2, which has a shear stability index of 60 or less.
21. The composition of claim 1, where the ethylene copolymer is made in a polymerization process using at least one metallocene catalyst.
22. The composition of claim 1 or 2 wherin the copolymer has a SSI (%) 30 cycle per ASTM D6278 less than 0.0003x-2.125 where x is Mw(LS) from GPC-3D;
23. A method of making a lubricant composition comprising blending an oil with long chain branched ethylene copolymer, wherein the copolymer has one or more of:
    (a) a Mw(LS)/Mn(DRI) from 2.0 to 6.5;
    (b) a Mw(LS) from 30,000 to 300,000 g/mol;
    (c) a g'_{vis} of from 0.5 to 0.97;

(d) an ethylene content of 40 wt% to 75 wt%;

(e) a shear stability index (30 cycles) of from 1% to 60%.

24. A method of lubricating an engine comprising supplying to the engine a lubricating oil composition comprising an oil and a long chain branched ethylene copolymer; wherein the long chain branched ethylene copolymer has one or more of the following: a) a Mw/Mn from 2.0 to 6.5; b) a Mw(LS) from 30,000 to 300,000 g/mol; c) a branching index (g'_{vis}) of from 0.5 to 0.97; d) an ethylene content of 40 wt% to 75 wt%, and (e) a shear stability index (30 cycles) of from 1% to 60%.

25. A polymerization process for producing a long chain branched ethylene propylene copolymer, wherein the process comprises: (i) contacting at a temperature greater than 50°C, ethylene and propylene with a catalyst system capable of producing long chain branched ethylene propylene copolymers having vinyl chain ends, and wherein the catalyst system comprises a metallocene catalyst compound and an activator; (ii) converting at least 50% of the ethylene and propylene to a polyolefin; and (iii) obtaining a long chain branched ethylene propylene copolymer having from 40% to less than 80% ethylene content by weight as determined by FTIR (ASTM D3900), wherein the copolymer has (a) a g'_{vis} of from 0.5 to 0.97, (b) a Mw(LS)/Mn(DRI) from 2.0 to 6.5 (c) a Mw(LS) from 30,000 to 300,000 g/mol.

26. A long chain branched ethylene propylene copolymer having from about 40% to less than 80% ethylene content by weight as determined by FTIR (ASTM D3900), wherein the polymer has a g'_{vis} of from 0.5 to 0.97; a Mw(LS)/Mn(DRI) from 2.5 to 6.5; a Mw(LS) from 30,000 to 300,000 g/mol; and two or more additional properties selected from:

(a) a branching index (g'_{vis}) less than -0.0003x +0.88, and greater than -0.0054x + 1.08, where x is the percent total monomer conversion.

(b) a r_1r_2 less than 2.0 and greater than 0.45;

(c) an "average sequence length for methylene sequences six and longer" less than 0.1869z – 0.30, and greater than 0.1869z - 1.9, where z is the mol% of ethylene as measured by ^{13}C NMR;

(d) a percentage of methylene sequence length of 6 or greater less than 1.3z - 35.5, and greater than 1.3z – 50, where z is the mol% of ethylene as measured by ^{13}C NMR;

(e) exhibiting no polymer crystallinity, or a polymer crystallinity wherein the heat of fusion(J/g) as measured by DSC is less than 2.8y – 134, where y is the wt% of ethylene as measured by FTIR;

(f) exhibiting no polymer crystallinity, or a polymer crystallinity wherein the heat of fusion(J/g) as measured by DSC is less than 1.47y – 64, where y is the wt% of ethylene as measured by FTIR;

(g) exhibiting a Tm of less than 50^{o}C as measured by DSC; and

(h) a shear thinning ratio of greater than 0.8572*EXP(2E-05*w) where w is the Mw(LS) from light scattering GPC-3D and the shear thinning ratio is defined as the complex viscosity at a frequency of 0.1 rad/s divided by the complex viscosity at a frequency of 100 rad/s.