CLAIMS

What is claimed is:

1. An ethylene copolymer comprising 40 wt.% to 70 wt.% of units derived from ethylene and at least 30 wt.% of units derived from at least one α-olefin having 3 to 20 carbon atoms, wherein the copolymer has the following properties:

(a) a weight-average molecular weight (Mw), as measured by GPC, in the range of about 50,000 to about 200,000 g/mol;

(b) a melting point (Tm) in °C, as measured by DSC, that satisfies the relation:

$$Tm > 3.4 \times E - 180$$

where E is the weight % of units derived from ethylene in the copolymer;

(c) a ratio of Mw/Mn of ~~1.8 to 2.5~~ about 1.5 to about 3.5;

(d) a content of Group 4 metals of no more than ~~5~~ 25 ppm; and

(e) a ratio of wt ppm Group 4 metals/ wt ppm Group 5 metals of at least 3.

2. The copolymer of claim 1 comprising 40 wt.% to 55 wt.% of units derived from ethylene.

3. The copolymer of claim 2 comprising 60 wt.% to 45 wt.% of units derived from at least one α-olefin having 3 to 20 carbon atoms.

4. The copolymer of claim 1 wherein said at least one α-olefin is selected from propylene, butene, hexene and octane.

5. The copolymer of claim 1 wherein said at least one α-olefin comprises propylene.

~~4.~~6. The copolymer of ~~any preceding~~ claim 1 having a melting point (Tm) in °C, as measured by DSC, that satisfies the relation:

$$Tm > 3.4 \times E - 170,$$

~~preferably Tm > 3.4 x E – 160;~~

~~more preferably Tm > 3.4 x E – 90~~

where E is the weight % of units derived from ethylene in the copolymer.

7. The copolymer of claim 1 having a melting point (Tm) in °C, as measured by DSC, that satisfies the relation:

$$Tm > 3.4 \times E - 160$$

where E is the weight % of units derived from ethylene in the copolymer.

8. The copolymer of claim 1 having a melting point (Tm) in °C, as measured by DSC, that satisfies the relation:

$$Tm > 3.4 \times E - 90$$

where E is the weight % of units derived from ethylene in the copolymer.

~~5. An ethylene copolymer comprising 70 wt.% to 85 wt.% of units derived from ethylene and at least 12 wt.% of units derived from at least one α-olefin having 3 to 20 carbon atoms, wherein the copolymer has the following properties:~~

~~(a) a weight average molecular weight (Mw), as measured by GPC, in the range of 50,000 to 200,000 g/mol;~~

~~(b) a melting point (Tm), as measured by DSC, of at least 100°C;~~

~~(c) a ratio of Mw/Mn of 1.8 to 2.5;~~

~~(d) a content of Group 4 metals of no more than 5 ppm; and~~

~~(e) a ratio of wt ppm Group 4 metals/ wt ppm Group 5 metals of at least 3.~~

~~6. The copolymer of claim 5 having a melting point (Tm), as measured by DSC, of at least 110°C.~~

~~7. The copolymer of any preceding claim wherein said at least one α-olefin is selected from propylene, butene, hexene and octene, and preferably comprises propylene.~~

~~8.~~9. The copolymer of ~~any preceding~~ claim 1 containing no more than ~~25~~ 10 ppm of Zn.

~~9.~~10. A process of producing ~~the copolymer of any one of claims 1 to 4, 7 and 8~~ an ethylene copolymer, the process comprising contacting a monomer mixture comprising 40 wt.% to 70 wt.% of ethylene and at least 30 wt.% of at least one α-olefin having 3 to 20 carbon atoms under polymerizations conditions with a catalyst composition comprising a bridged bis-indenyl complex of a transition metal to produce a copolymer having the following properties:

(a) a weight-average molecular weight (Mw), as measured by GPC, in the range of about 50,000 to about 200,000 g/mol;

(b) a melting point (Tm) in °C, as measured by DSC, that satisfies the relation:

$$Tm > 3.4 \times E - 180$$

where E is the weight % of units derived from ethylene in the copolymer;

(c) a ratio of Mw/Mn of about 1.5 to about 3.5;

(d) a content of Group 4 metals of no more than 25 ppm; and

(e) a ratio of wt ppm Group 4 metals/ wt ppm Group 5 metals of at least 3.

~~10. A process of producing the copolymer of any one of claims 5 to 8, the process comprising contacting a monomer mixture comprising 70 to 85 wt.% of ethylene and at least 12 wt.% of at least one α-olefin having 3 to 20 carbon atoms under polymerizations conditions with a catalyst composition comprising a bridged bis-indenyl complex of a transition metal.~~

11. The process of claim 10 wherein the bridged bis-indenyl complex comprises a dialkylsilyl bridging group.

~~11.~~12. The process of ~~claim 9 or~~ claim 10 wherein the transition metal comprises hafnium and/or zirconium.

~~12.~~13. The process of ~~any one of claims 9 to 11~~ claim 10 wherein the ~~bridged bis-indenyl complex comprises a dialkylsilyl bridging group, and preferably~~ catalyst composition comprises dimethylsilylbisindenyl hafnium dimethyl.

~~13.~~14. The process of ~~any one of claims 9 to 12~~ claim 10 wherein the catalyst composition comprises a fluoroarylborate activator~~, and preferably comprises a perfluorophenylborate activator~~.

15. The process of claim 10 wherein the catalyst composition comprises a perfluorophenylborate activator.

~~14.~~16. The process of ~~any one of claims 9 to 13~~ claim 10 wherein the catalyst composition comprises ~~a~~ rac-dimethylsilylbisindenyl hafnium dimethyl and a trimethylammonium tetrakis-pentafluorophenylborate activator.

17. A lubricating oil composition comprising (a) a lubricating oil base and (b) ethylene copolymer comprising 40 wt.% to 70 wt.% of units derived from ethylene and at least 30 wt.% of units derived from at least one α-olefin having 3 to 20 carbon atoms, wherein the copolymer has the following properties:

(a) a weight-average molecular weight (Mw), as measured by GPC, in the range of about 50,000 to about 200,000 g/mol;

(b) a melting point (Tm) in °C, as measured by DSC, that satisfies the relation:

$$Tm > 3.4 \times E - 180$$

where E is the weight % of units derived from ethylene in the copolymer;

(c) a ratio of Mw/Mn of about 1.5 to about 3.5;

(d) a content of Group 4 metals of no more than 25 ppm; and

(e) a ratio of wt ppm Group 4 metals/ wt ppm Group 5 metals of at least 3.