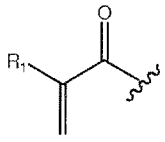
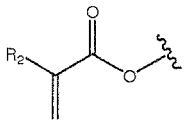
CLAIMS

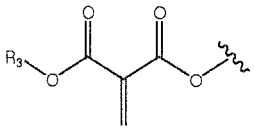
1. An ethylene-based polymer formed from at least the following: ethylene and a "monomeric chain transfer agent (monomeric CTA)," comprising a "copolymerization end" and a "chain transfer end."

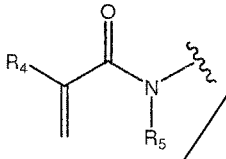
2. The ethylene-based polymer of Claim 1, and wherein the "monomeric chain transfer agent" is not a "non-conjugated diunsaturated monomer."

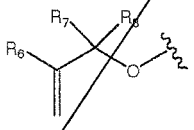
3. The ethylene-based polymer of Claim 1 or Claim 2, wherein the "copolymerization end" of the monomeric chain transfer agent is selected from the group consisting of the following:

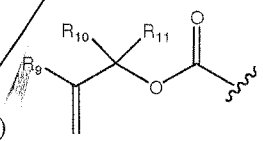
a)  , where R1 is selected from H, CH3, CH2CH3, CN, or COCH3;

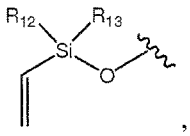
b)  , where R2 is selected from H, CH3, CH2CH3, CN, or COCH3;

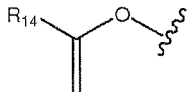
c)  , where R3 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl;

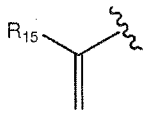
d)  , where R4 is selected from H, CH3, CH2CH3, CN, or COCH3, and R5 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, Phenyl, or COCH3;

e)  , where R6, R7, R8 are each independently selected from H, CH3, or CH2CH3;

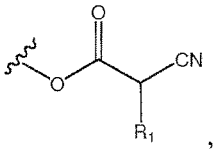
f)  , where R9, R10, R11 are each independently selected from H, CH3, or CH2CH3;

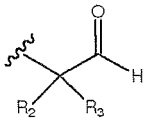
g) , where R12, R13 are each independently selected from H, CH3, CH2CH3 or Phenyl;

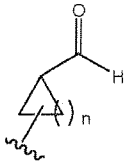
h) , where R14 is selected from H, CH3, CH2CH3, or CN; and

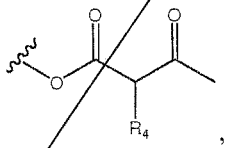
i) , where R15 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl.

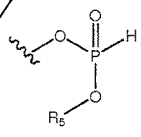
4. The ethylene-based polymer of any of the previous claims, wherein the "chain transfer end" of the monomeric chain transfer agent is selected from the group consisting of the following:

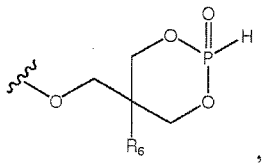
1) , where R1 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, COCH3, Cl, Br, or I;

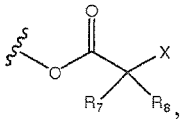
2) , where R2, R3 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, or COCH3;

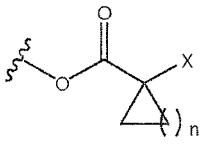
3) , where n is from 1 to 6;

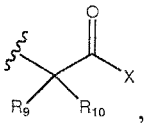
4) , where R4 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, Phenyl, Cl, Br, or I;

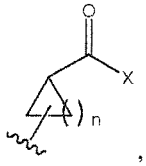
5) , where R5 is selected from C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl;

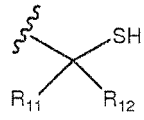
6)  , where R6 is selected from C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl;

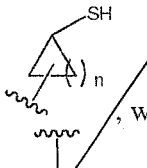
7)  , where R7, R8 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, Phenyl, Cl, Br, or I; and X is selected from F, Cl, Br, or I;

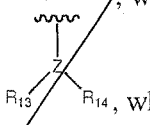
8)  , where X is selected from Cl, Br, or I; and n is from 1 to 6;

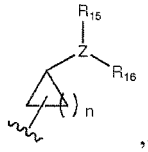
9)  , where R9, R10 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, or COCH3; and X is selected from Cl, Br, or I;

10)  , where X is selected from Cl, Br, or I; and n is from 1 to 6;

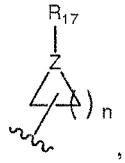
11)  , where R11, R12 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, or COCH3;

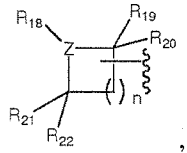
12)  , where n is from 1 to 6;

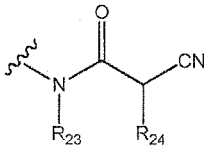
13)  , where R13 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl; R14 is selected from H, C1-C22 alkyl, or C3-C8 cycloalkyl; and Z is selected from N or P;

14)  , where R15 is selected from H, C1-C22 alkyl, C3-C8

cycloalkyl, or Phenyl; R16 is selected from H, C1-C22 alkyl, or C3-C8 cycloalkyl; Z is selected from N or P; and n is from 1 to 6;

15)  , where R17 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl; Z is selected from N or P; and n is from 1 to 6;

16)  , where R18, R19, R20, R21, R22 are each independently selected from H, C1-C22 alkyl, or C3-C8 cycloalkyl; Z is selected from N or P; and n is from 1 to 6; and

17)  , where R23 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl; and R24 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, COCH3, Cl, Br, or I.

5. The ethylene-based polymer of any of the previous claims, wherein the ethylene-based polymer comprises, in reacted form, at least 0.075 moles of the monomeric CTA per 1000 moles of ethylene-based backbone carbons, based on the weight of the polymer.

6. The ethylene-based polymer of any of the previous claims, wherein the monomeric CTA has 1H NMR signals from 3.0 to 5.0 ppm chemical shift.

7. The ethylene-based polymer of any of the previous claims, wherein the ethylene-based polymer has a melt strength [MS] (cN) and melt index I2 (g/10 min) according to the following equation:

$$[MS] > 15.5 * EXP[-\frac{\log(I_2)}{1.07}] - 2.4$$

8. The ethylene-based polymer of any of the previous claims, wherein the polymer has a strain hardening factor (SHF) greater than 3, at Hencky strain rates from 10 s^{-1} to 1.0 s^{-1}.

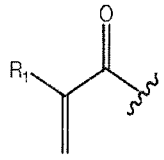
9. A composition comprising the ethylene-based polymer of any of the previous claims.

10. An article comprising at least one component formed from the composition of Claim 9.

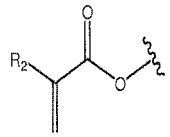
CLAIMS

1. An ethylene-based polymer, comprising a majority amount of polymerized ethylene, based on the weight of the polymer, formed from at least the following: ethylene and a "monomeric chain transfer agent (monomeric CTA)," comprising a "copolymerization end" and a "chain transfer end";

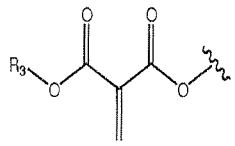
wherein the "copolymerization end" of the monomeric chain transfer agent is selected from the group consisting of the following:

a) 

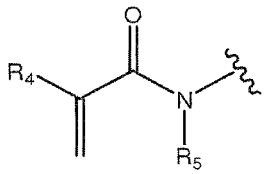
, where R1 is selected from H, CH3, CH2CH3, CN, or COCH3;

b) 

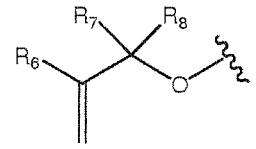
, where R2 is selected from H, CH3, CH2CH3, CN, or COCH3;

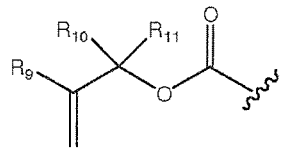
c) 

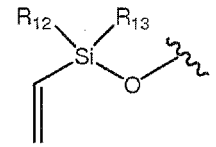
, where R3 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl;

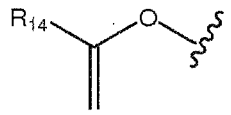
d) 

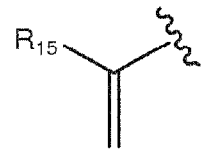
, where R4 is selected from H, CH3, CH2CH3, CN, or COCH3, and R5 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, Phenyl, or COCH3;

e) , where R6, R7, R8 are each independently selected from H, CH3 or CH2CH3;

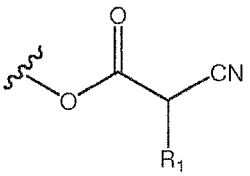
f) , where R9, R10, R11 are each independently selected from H, CH3, or CH2CH3;

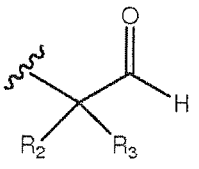
g) , where R12, R13 are each independently selected from H, CH3, CH2CH3 or Phenyl;

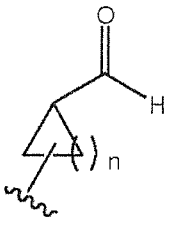
h) , where R14 is selected from H, CH3, CH2CH3, or CN; and

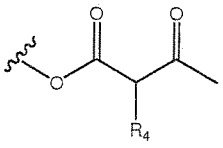
i) , where R15 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl or Phenyl, and

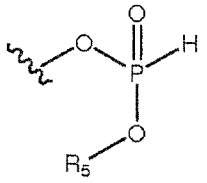
the "chain transfer end" of the monomeric chain transfer agent is selected from the group consisting of the following:

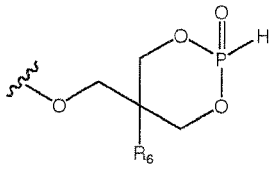
1) , where R1 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, COCH3, CI, Br, or I;

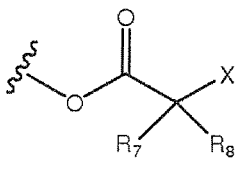
2)  , where R2, R3 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, or COCH3;

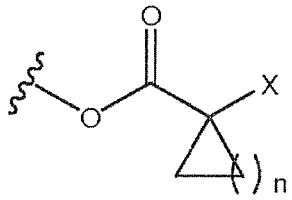
3)  , where n is from 1 to 6;

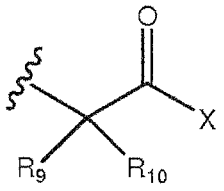
4)  , where R4 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, phenyl, Cl, Br, or I;

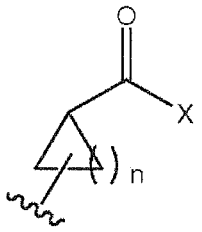
5)  , where R5 is selected from C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl;

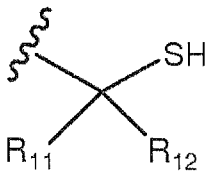
6)  , where R6 is selected from C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl;

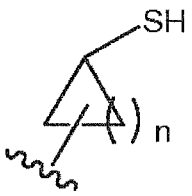
7)  where R7, R8 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, Phenyl, Cl, Br, or I; and X is selected from F, Cl, Br, or I;

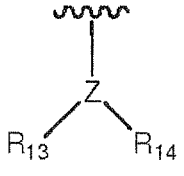
8)  , where X is selected from C1, Br, or I; and n is from 1 to 6;

9)  , where R9, R10 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, or COCH3; and X is selected from C1, Br, or I;

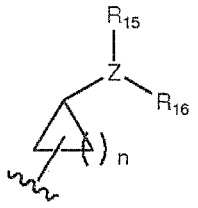
10)  , where X is selected from C1, Br, or I; and n is from 1 to 6;

11)  , where R11, R12 are each independently selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, or COCH3;

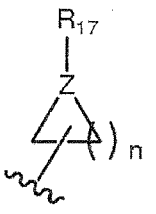
12)  , where n is from 1 to 6;

13) 

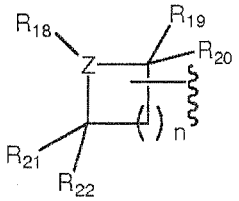
, where R13 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl; R14 is selected from H, C1-C22 alkyl, or C3-C8 cycloalkyl; and Z is selected from N or P;

14) 

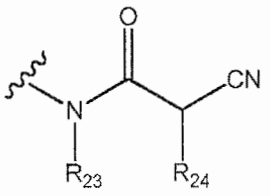
, where R15 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl; R16 is selected from H, C1-C22 alkyl, or C3-C8 cycloalkyl; Z is selected from N or P; and n is from 1 to 6;

15) 

, where R17 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl; Z is selected from N or P; and n is from 1 to 6;

16) 

, where R18, R19, R20, R21, R22 are each independently selected from H, C1-C22 alkyl, or C3-C8 cycloalkyl; Z is selected from N or P; and n is from 1 to 6; and

17)  , where R23 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, or Phenyl; and R24 is selected from H, C1-C22 alkyl, C3-C8 cycloalkyl, CN, Phenyl, COCH3, C1, Br, or I.

2. The ethylene-based polymer of Claim 1, and wherein the "monomeric chain transfer agent" is not a "non-conjugated diunsaturated monomer."

3. The ethylene-based polymer of any of the previous claims, wherein the ethylene -based polymer comprises, in reacted form, at least 0.075 moles of the monomeric CTA per 1000 moles of ethylene-based backbone carbons, based on the weight of the polymer.

4. The ethylene-based polymer of any of the previous claims, wherein the monomeric CTA has 1H NMR signals from 3.0 to 5.0 ppm chemical shift.

5. The ethylene-based polymer of any of the previous claims, wherein the ethylene-based polymer has a melt strength [MS] (cN), as measured at 190°C using a Goettfert Rheotens 71.97, and melt index I2 (g/10 min), as measured in accordance by ASTM D 1238, Condition 190°C/2.16 kg, according to the following equation:

$$[MS] > 15.5 * EXP[-\frac{\log(I_2)}{1.07}] - 2.4$$

6. The ethylene-based polymer of any of the previous claims, wherein the polymer has a strain hardening factor

(SHF) greater than 3, at Hencky strain rates from 10 s^{-1} to 1.0 s^{-1} wherein the SHF is the ratio of the extensional viscosity to three times of the shear viscosity at the same measurement time and at the same temperature, the measurement time being the ratio of "three" to the "applied Hencky strain rate in the extensional viscosity measurement".

7. A composition comprising the ethylene-based polymer of any of the previous claims.

8. An article comprising at least one component formed from the composition of Claim 7.