

CLAIMS

1. A process to form an ethylene-based polymer, in the presence of at least one free-radical, said process comprises at least the following:
polymerizing a mixture comprising ethylene, in a reactor configuration comprising at
5 least three reaction zones, and comprising two ethylene feed streams, and
wherein the ratio ($R_{LCBf\ 40\%}$), in percent, of the “LCB content of the first 40 wt% of the total polymer formed” to “the total LCB content in the final polymer” is $\leq 22.5\%$; and
wherein the amount of ethylene, and optionally one or more comonomers, and optionally one or more CTAs, fed to the first reaction zone, is from 40 mole% to 80 mole%, based on the
10 total moles of ethylene, and optionally one or more comonomers, and optionally one or more CTAs, fed to the polymerization.
2. The process of claim 1, wherein the reactor configuration contains only two ethylene feed streams.
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3. The process of claim 1, wherein the LCB ratio ($R_{LCBf\ 60\%/LCBf\ 40\%}$) of the “last 60 wt% total polymer formed” to the “first 40 wt% of total polymer formed,” is greater than, or equal to, 6.8.
- 20 4. The process of any one of the previous claims, wherein the amount of ethylene, and optionally one or more comonomers, and optionally one or more CTAs, fed to the first reaction zone, is from 45 mole% to 75 mole%, based on the total moles of ethylene, and optionally one or more comonomers, and optionally one or more CTAs, fed to the polymerization.
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5. The process of any one of the previous claims, wherein the ethylene conversion is greater than, or equal to, 28%.
6. The process of any one of the previous claims, wherein the ethylene is fed to a first
30 reaction zone ($i = 1$) and to one subsequent reaction zone ($i = n$, and $n > 1$), and wherein the ethylene comprises fresh ethylene and recycle ethylene, and
wherein for the subsequent reaction zone, the ratio, R_n , of “mole fraction of fresh ethylene fed to the first reaction zone ($RZ1$)” to “mole fraction of fresh ethylene fed to the n th reaction zone (RZn)” is ($R_n = RZ1/RZn$) less than, or equal to, 1; and

wherein the “total amount of ethylene fed to the polymerization process” derives from at least one fresh ethylene stream and at least one recycled ethylene stream.

7. The process of any one of the previous claims, wherein the first ethylene feed stream
5 comprises from 30 to 100 mole% of the total amount of fresh CTA added to the
polymerization, and wherein the activity of the CTA system in the first ethylene feed (Z1) is
greater than, or equal to, the activity of the CTA system in the second ethylene feed (Z2).
8. The process of any one of the previous claims, wherein the ethylene-based polymer
10 has a melt index (I2) from 0.10 to 20.0 g/10 min.
9. The process of any one of the previous claims, wherein the mixture further comprises
at least one CTA selected from an aldehyde, an alkane, a ketone, an alcohol, an ester, an
alpha-olefin, or a combination thereof.
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10. The process of any one of the previous claims, wherein the ethylene-based polymer is
an LDPE.