CLAIMS

The invention claimed is:

1. A method comprising:

providing a predictive melt index regression derived at least in part on data from a previous production run of a first polyolefin having a first melt index formed by reacting an olefin monomer with a catalyst system in the presence of an induced condensing agent (ICA) and optionally hydrogen, wherein the predictive melt index regression is based on an effect of a concentration of the ICA in the reactor and optionally an effect of a concentration of hydrogen in the reactor on the melt index of the first polyolefin, and wherein a smoothing function using a time constant represents the concentration of the ICA in the predictive melt index regression;

contacting in a fluidized bed gas phase reactor the olefin monomer with the catalyst system in the presence of an ICA and optionally hydrogen to produce a second polyolefin having a second melt index;

monitoring a reactor ICA concentration and optionally a reactor hydrogen concentration;

calculating a predicted melt index for the second polyolefin using the predictive melt index regression based on a change to the reactor ICA concentration; and

adjusting the reactor ICA concentration based on the predicted melt index to maintain the second melt index within or move the second melt index to within a melt index threshold range.

2. The method of claim 1, wherein terms of the predictive melt index regression associated with the concentration of the ICA and the concentration of the hydrogen independently include a smoothing function that incorporates a time constant.

3. The method of claim 1 or 2, wherein the catalyst system includes a high molecular weight (HMW) catalyst and a low molecular weight (LMW) catalyst, wherein the method further includes:

monitoring a mole ratio of the HMW catalyst and the LMW catalyst (HMW_{mol}:LMW_{mol}) in the reactor, and

calculating the predictive melt index regression further based on an effect of the HMW_{mol}:LMW_{mol} on the melt index of the polyolefin; or

further comprising adjusting the mole ratio of the HMW catalyst and the LMW catalyst (HMW_{mol}:LMW_{mol}) in the reactor based on the predicted melt index; or

wherein the time constant associated with the concentration of the ICA is about 50 minutes or greater; or

wherein the time constant associated with the concentration of the ICA is about 100 minutes to about 300 minutes; or

wherein the smoothing function is an exponential smoothing function; or

wherein the predictive melt index regression includes an exponential function; or

wherein the concentration of the ICA is represented by a partial pressure of the ICA (ICA_{PP}); or

wherein the concentration of the hydrogen is represented by a mole percent of total reactor gas ratio of the hydrogen to the olefin monomer ($H2_{mol}$:$olefin_{mol}$); or

wherein the predictive melt index regression includes at least one additional term associated with reactor temperature or polymer residence time.

4. A method comprising:

providing a predictive melt index regression derived at least in part on data from a previous production run of a first polyolefin having a first melt index formed by reacting an olefin monomer and at least one comonomer with a catalyst system in the presence of an induced condensing agent (ICA) and optionally hydrogen, wherein the predictive melt index regression is based on an effect of a concentration of the ICA in the reactor, an effect of a concentration of the comonomer in the reactor, and optionally an effect of a concentration of hydrogen in the reactor on the melt index of the first polyolefin, and wherein a smoothing function using a time constant represents the concentration of the ICA in the predictive melt index regression;

contacting in a fluidized bed gas phase reactor the olefin monomer and the at least one comonomer with the catalyst system in the presence of the ICA and optionally the hydrogen to produce a second polyolefin having a second melt index;

monitoring a reactor ICA concentration and optionally a reactor hydrogen concentration;

calculating a predicted melt index for the second polyolefin using the predictive melt index regression based on a change to the reactor ICA concentration; and

adjusting the reactor ICA concentration based on the predicted melt index to maintain the second melt index within or move the second melt index to within a melt index threshold range.

5. The method of claim 4, wherein terms of the predictive melt index regression associated with the concentration of the ICA, the concentration of the comonomer, and the concentration of the hydrogen, if used, each independently include a smoothing function that incorporates a time constant; or

wherein the olefin monomer is ethylene and the at least one comonomer is selected from the group consisting of propylene, 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 4-methylpent-1-ene, 1-decene, 1-dodecene, 1-hexadecene, 1,3-hexadiene, 1,4-hexadiene, cyclopentadiene, dicyclopentadiene, 4-vinylcyclohex-1-ene, methyloctadiene, 1-methyl-1,6-octadiene, 7-methyl-1,6-octadiene, 1,5-cyclooctadiene, norbornadiene, ethylidene norbornene, 5-vinylidene-2-norbornene, 5-vinyl-2-norbornene, isoprene, styrene, butadiene, isobutylene, chloroprene, acrylonitrile, and a cyclic olefin; or

wherein the catalyst system includes a high molecular weight (HMW) catalyst and a low molecular weight (LMW) catalyst, wherein the method further includes:

monitoring a mole ratio of the HMW catalyst and the LMW catalyst (HMW_{mol}:LMW_{mol}) in the reactor, and

calculating the predictive melt index regression further based on an effect of the HMW_{mol}:LMW_{mol} on the melt index of the polyolefin; or

further comprising adjusting the mole ratio of the HMW catalyst and the LMW catalyst (HMW_{mol}:LMW_{mol}) in the reactor based on the predicted melt index; or

wherein the time constant associated with the concentration of the ICA is about 50 minutes or greater; or

wherein the time constant associated with the concentration of the ICA is about 100 minutes to about 300 minutes; or

wherein the smoothing function is an exponential smoothing function; or

wherein the predictive melt index regression is an exponential function; or

wherein the concentration of the ICA is represented by a partial pressure of the ICA (ICA_{PP}); or

wherein the concentration of the hydrogen is represented by a mole percent of total reactor gas ratio of the hydrogen to the olefin monomer ($H2_{mol}$:$olefin_{mol}$); or

wherein the concentration of the comonomer is represented by a mole percent of total reactor gas ratio of the olefin monomer and the at least one comonomer ($olefin_{mol}$:$comonomer_{mol}$); or

wherein the predictive melt index regression includes at least one additional term associated with reactor temperature or polymer residence time.

6. A method comprising:

contacting in a fluidized bed gas phase reactor an olefin monomer with a catalyst system in the presence of an induced condensing agent (ICA) and optionally hydrogen to produce a polyolefin having a melt index;

monitoring a reactor ICA concentration, optionally a reactor hydrogen concentration, and the melt index of the polyolefin;

calculating a predictive melt index regression based on an effect of the concentration of the ICA in the reactor and optionally an effect of the hydrogen in the reactor on the melt index of the polyolefin, wherein the concentration of the ICA is in the predictive melt index regression is represented by a smoothing function that incorporates a time constant;

calculating a predicted melt index using the predictive melt index regression based on a change in the reactor ICA concentration; and

adjusting the reactor ICA concentration based on the predicted melt flow index to maintain the melt index within or move the melt index to within a melt index threshold range.

7. The method of claim 6, wherein terms of the predictive melt index regression associated with the concentration of the ICA and the concentration of the hydrogen are each independently represented by a smoothing function that incorporates a time constant.

8. The method of claim 6, further comprising:

contacting in the fluidized bed gas phase reactor the olefin monomer and at least one comonomer with the catalyst system in the presence the ICA and optionally hydrogen to produce the polyolefin; and

monitoring a mole percent of total reactor gas ratio of the olefin monomer and the at least one comonomer ($olefin_{mol}$:$comonomer_{mol}$);

calculating the predictive melt index regression further based on an effect of the $olefin_{mol}$:$comonomer_{mol}$ on the melt index of the polyolefin where a term of the predictive melt index regression associated with the $olefin_{mol}$:$comonomer_{mol}$ is a smoothing function that incorporates a time constant.

9. The method of claim 6, wherein the catalyst system includes a high molecular weight (HMW) catalyst and a low molecular weight (LMW) catalyst, wherein the method further includes:

monitoring a mole ratio of the HMW catalyst and the LMW catalyst (HMW_{mol}:LMW_{mol}) in the reactor, and

calculating the predictive melt index regression further based on an effect of the HMW_{mol}:LMW_{mol} on the melt index of the polyolefin.

10. The method of claim 6, further comprising adjusting the mole ratio of the HMW catalyst and the LMW catalyst (HMW_{mol}:LMW_{mol}) in the reactor based on the predicted melt index; or

wherein the time constant associated with the concentration of the ICA is about 50 minutes or greater; or

wherein the time constant associated with the concentration of the ICA is about 100 minutes to about 300 minutes; or

wherein the smoothing function is an exponential smoothing function; or

wherein the predictive melt index regression is an exponential function; or

wherein the concentration of the ICA is represented by a partial pressure of the ICA (ICA_{PP}); or

wherein the concentration of the hydrogen is represented by a mole percent of total reactor gas ratio of the hydrogen to the olefin monomer ($H2_{mol}$:$olefin_{mol}$); or

wherein the concentration of the comonomer is represented by a mole percent of total reactor gas ratio of the olefin monomer and the at least one comonomer ($olefin_{mol}$:$comonomer_{mol}$); or

wherein the predictive melt index regression includes at least one additional term associated with reactor temperature or polymer residence time.