Claims

1. A method of determining a relative decrease in catalytic efficacy of a catalyst in a test sample of a catalyst solution in which the catalyst in the catalyst solution has an unknown catalytic activity, the method comprising:

(a) mixing the test sample with a test solvent to form a test mixture, wherein the test solvent has predetermined amounts of both an alpha-olefin and an activator, and wherein the alpha-olefin exothermically polymerizes in the presence of the activator and the catalyst to increase a temperature of the test sample;

(b) measuring the increase in the temperature of the test mixture at predetermined time intervals immediately after forming the test mixture;

(c) determining a test value of a predetermined feature in the increase in temperature measured in (b);

(d) determining a control value of the predetermined feature in a known increase in temperature of a control mixture of the test solvent with a control sample of a control catalyst solution measured over the predetermined time intervals immediately after forming the control mixture, wherein the catalyst in the control sample has a known catalytic activity and wherein both the test sample and the control sample have the same predefined volume and predetermined weight percent of the catalyst; and

(e) determining the relative decrease in catalytic efficacy of the catalyst in the test sample having the unknown catalytic activity from the equation:

$$\text{Relative Decrease in Catalytic Efficacy} = \frac{\text{Control Value} - \text{Test Value}}{\text{Control Value}}.$$

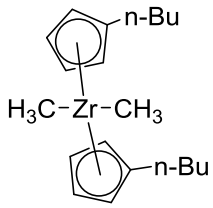
2. The method of claim 1, wherein the predetermined feature is a maximum temperature value reached during the increase in temperature over the predetermined time intervals.

3. The method of claim 1, wherein the predetermined feature is a rate of temperature increase over a set time interval during the predetermined time intervals.

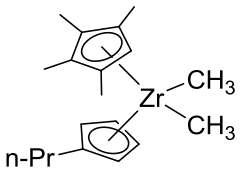
4. The method of any one of claims 1-3, wherein the alpha-olefin is a C4 to C12 alpha-olefin.

5. The method of any one of claims 1-3, where the catalyst is a metallocene catalyst.

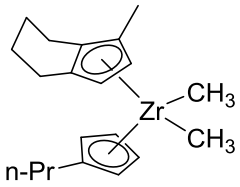
6. The method of claim 5, wherein the metallocene catalyst is selected from the group consisting of



BMe2



[X-1]Me2 and



[Y-2]Me2 .

7. The method of any one of claims 1-6, wherein the activator is selected from the group consisting of modified methyl aluminoxane (MMAO), bis(hydrogenated tallow alkyl)methyl, tetrakis(pentafluorophenyl)borate(l-)amine (RIBS-2), triethyl aluminum (TEAL), and combinations thereof.

8. The method of any one of claims 1-3, wherein measuring the increase in temperature in (b) and measurements for the known increase in temperature of the control mixture from (d) are done under adiabatic conditions; or
wherein the catalyst solution is a trim solution.

9. A method of trimming a polymerization reaction in a polymerization reactor, the method comprising;

determining, according to claim 8, a relative decrease in catalytic efficacy of a catalyst in a test sample of a trim solution in which the catalyst has an unknown catalytic activity;

determining, based on the relative decrease in catalytic efficacy, an increased amount of the trim solution to trim the polymerization reactor relative to an amount of control trim solution having a known catalytic activity; and

introducing the increased amount of the trim solution into the polymerization reactor.

10. The method of claim 9, wherein the increased amount of the trim solution increases relative to the amount of control trim solution to mitigate the relative decrease in catalytic efficacy and provide an effective catalyst efficacy equal to the known catalytic activity.