from about 10 to about 60, measured according to ASTM D1238 (I_{21} and I_5 measured at 190°C and 21.6 kg or 5 kg weight respectively), a flow index (I_{21}) in the range from about 2 to about 60, a low temperature notched Charpy impact greater than about 6.0 kJ/m^2, a melt strength greater than or equal to about 5.0 cN, and an ESCR of greater than or equal to about 50 hours, as measured by ASTM 1693, condition B.

[0017] There is also provided a polyethylene resin comprising units derived from ethylene, and optionally one or more other olefins, wherein the resin has a density greater than or equal to about 0.945 g/cm^3, measured according to ASTM D792, a melt flow ratio (I_{21}/I_5) in the range from about 10 to about 60, measured according to ASTM D1238 (I_{21} and I_5 measured at 190°C and 21.6 kg or 5 kg weight respectively), a flow index (I_{21}) in the range from about 2 to about 60, a low temperature notched Charpy impact greater than about 7.0 kJ/m^2, a melt strength greater than or equal to about 7.0 cN, and an ESCR of greater than or equal to about 70 hours, as measured by ASTM 1693, condition B.

[0018] The polyethylene resin may be a unimodal resin, a bimodal resin or a multimodal resin.

[0019] The polyethylene resins may be formed by contacting ethylene, hydrogen, and optionally one or more other olefins, with a catalyst system. The catalyst system may comprise at least two different catalyst compounds. The at least two different catalyst compounds may produce different average molecular weight polyethylene resin at the same ratio of hydrogen to ethylene.

[0019a] In one aspect, there is provided a polyethylene resin comprising units derived from ethylene, and optionally one or more other olefins, wherein the resin has a density greater than or equal to 0.945 g/cm^3, measured according to ASTM D792, a melt flow ratio (I_{21}/I_5) in the range from 10 to 60, measured according to ASTM D1238 (I_{21} and I_5 measured at 190°C and 21.6 kg or 5 kg weight respectively), and a flow index (I_{21}) in the range from 2 to 60, wherein the resin is formed by contacting the ethylene, hydrogen, and optionally one or more other olefins, with a catalyst system comprising at least two different catalyst compounds in an in-reactor ratio from 2.5 to 1.8 and changing the ratio of hydrogen to ethylene to modify a weight swell of the polyethylene resin from a high weight swell resin or a low weight swell resin to the other of the high weight swell resin or the low weight swell resin.

CLAIMS

What is claimed is:

1. A polyethylene resin comprising units derived from ethylene, and optionally one or more other olefins, wherein the resin has a density greater than or equal to 0.945 g/cm^3, measured according to ASTM D792, a melt flow ratio (I_{21}/I_5) in the range from 10 to 60, measured according to ASTM D1238 (I_{21} and I_5 measured at 190°C and 21.6 kg or 5 kg weight respectively), and a flow index (I_{21}) in the range from 2 to 60, wherein the resin is formed by contacting the ethylene, hydrogen, and optionally one or more other olefins, with a catalyst system comprising at least two different catalyst compounds in an in-reactor ratio from 2.5 to 1.8 and changing the ratio of hydrogen to ethylene to modify a weight swell of the polyethylene resin from a high weight swell resin or a low weight swell resin to the other of the high weight swell resin or the low weight swell resin.

2. The polyethylene resin of claim 1 further possessing a low temperature notched Charpy impact greater than 6.0 kJ/m^2, measured according to ISO 179.

3. The polyethylene resin of claim 1 further possessing a melt strength greater than or equal to 6.0 cN.

4. The polyethylene resin of claim 1 further possessing an environmental stress crack resistance (ESCR) of greater than or equal to 50 hours, as measured by ASTM 1693, condition B.

5. The polyethylene resin of claim 1 wherein the at least two different catalyst compounds produce different average molecular weight polyethylene at the same ratio of hydrogen to ethylene.

6. The polyethylene resin of claim 5 wherein the melt flow ratio of the resin is adjustable by changing the ratio of hydrogen to ethylene.

7. The polyethylene resin of any one of claim 5 wherein the weight swell of the resin is adjustable by changing the ratio of hydrogen to ethylene.

8. The polyethylene resin of claim 5 wherein the melt flow ratio of the resin is adjustable by changing the ratio of hydrogen to ethylene and changing the ratio of the at least two different catalyst compounds in the in-reactor ratio from 2.5 to 1.8.

9. The polyethylene resin of claim 5 wherein the melt flow ratio and/or weight swell is further adjustable by changing the temperature at which the resin is formed.

10. The polyethylene resin of any one of claims 5 to 9 wherein the catalyst system comprises at least one metallocene catalyst compound and/or at least one Group 15 and metal containing catalyst compound.