

Claims

1. A process for separating hydrogen from a gaseous feed stream in a polymerisation process, comprising the steps:
 - i. polymerising an olefin monomer and optionally at least one olefin comonomer, in the presence of a solvent, optionally in the presence of hydrogen, so as to form a polymerisation reaction mixture comprising a polyolefin polymer, unreacted monomer(s), solvent and hydrogen;
 - ii. separating said polyolefin polymer from said unreacted monomer(s), solvent and hydrogen;
 - iii. feeding said unreacted monomer(s), solvent and hydrogen to a separator so as to form said gaseous feed stream;
 - iv. contacting said gaseous feed stream with a hydrogen separating membrane so as to form a hydrogen-rich gaseous stream and a hydrogen-lean gaseous stream.
2. The process as claimed in claim 1 or 2, wherein said polymerisation process is a solution polymerisation process.
3. The process as claimed in any of claims 1 to 3, further comprising
 - v. recycling the hydrogen-lean gaseous stream from step iv to step i.
4. The process as claimed in any of claims 1 to 4, wherein said polyolefin is polyethylene.
5. The process as claimed in claim 5, wherein said polyethylene is a polyethylene homopolymer or a polyethylene copolymer of ethylene and at least one alpha-olefin comonomer, such as a C3-C8 alpha-olefin comonomer.
6. The process as claimed in any of claims 1 to 6, wherein step i. is carried out in the presence of a polymerisation catalyst, preferably a metallocene catalyst.
7. The process as claimed in any of claims 1 to 7, wherein the separation efficiency of step iv. is at least 75%, preferably at least 80%, such as at least 90%.

8. The process as claimed in any of claims 1 to 8, wherein said membrane is a polymeric or inorganic membrane.
9. The process as claimed in any of claims 1 to 9, wherein only a single hydrogen separating membrane is used.
10. Use of a hydrogen separating membrane for the separation of hydrogen in a process as defined in any of claims 1 to 10.
11. Apparatus arranged to perform the process as defined in any of claims 1 to 10 comprising:
 - a) At least one reactor configured to receive an olefin monomer and optionally at least one olefin comonomer, solvent and optionally hydrogen via at least one first inlet so as to produce a polymerisation reaction mixture comprising a polyolefin polymer, unreacted monomer(s), solvent and hydrogen;
 - b) A first separator in fluid communication with said reactor configured to receive said polymerisation reaction mixture via at least one second inlet so as to separate said polyolefin polymer from said unreacted monomer(s), solvent and hydrogen;
 - c) A second separator in fluid communication with said first separator configured to receive said unreacted monomer(s), solvent and hydrogen via at least one third inlet so as to produce a gaseous feed stream; and
 - d) A membrane contactor in fluid communication with said second separator configured to receive said gaseous feed stream via at least one fourth inlet so as to produce a hydrogen-rich gaseous stream and a hydrogen-lean gaseous stream.
12. The apparatus as claimed in claim 11, wherein only a single membrane contactor is present.
13. A process for controlling the molecular weight of a polyolefin polymer comprising the steps:

- i. polymerising an olefin monomer and optionally at least one olefin comonomer in the presence of a solvent, optionally in the presence of hydrogen, so as to form a polymerisation reaction mixture comprising a polyolefin polymer, unreacted monomer(s), solvent and hydrogen;
- ii. separating said polyolefin polymer from said unreacted monomer(s), solvent and hydrogen;
- iii. feeding said unreacted monomer(s), solvent and hydrogen to a separator so as to form said gaseous feed stream;
- iv. contacting said gaseous feed stream with a hydrogen separating membrane so as to form a hydrogen-rich gaseous stream and a hydrogen-lean gaseous stream.
- v. recycling the hydrogen-lean gaseous stream from step iv to step i.