

Dry Goods Sharing Detailed Interpretation of High Pressure Low Density Polyethylene Production Process Technology _ Reaction

Keywords

Hits 182

URL

Original Title: Dry Goods Sharing Detailed Interpretation of High Pressure Low Density Polyethylene Production Process Technology Low density polyethylene (LDPE) is a thermoplastic resin obtained by free radical polymerization with polymerization grade ethylene as polymerization monomer and peroxide as initiator. Its molecular weight is generally between 100000 and 500000, and its density is 0.91 ~ 0.93 G/cm³. It is the lightest variety of polyethylene resin. It has good softness, extensibility, electrical insulation, transparency, easy processing and certain air permeability. It has good chemical stability, alkali resistance and general organic solvent resistance, and has a wide range of applications, including extrusion coating, blown film, wire and cable coating, injection molding and blow molding. As the service life of the free radicals generated by the initiator is relatively short, the ethylene is highly compressed by increasing the reaction pressure (110-350MPa), so that the density of the ethylene is increased to 0.5g/cm³, which is similar to a liquid that can not be compressed any more, so as to shorten the distance between ethylene molecules and increase the collision probability between free radicals or active propagation chains and ethylene molecules for free radical polymerization. Low density polyethylene is produced, so low density polyethylene is also called high pressure low density polyethylene. Low density polyethylene production process The production process of low density polyethylene mainly includes ethylene two-stage compression, initiator and regulator injection, polymerization system, high and low pressure separation and recovery system, extrusion granulation and post-treatment system. According to the different types of reactors, it can be divided into high-pressure tube method and autoclave method. The tubular process and the autoclave process have their own characteristics. The tubular reactor is simple in structure, easy to manufacture and maintain, and can withstand higher pressure. The structure of kettle reactor is complex, and it is relatively difficult to maintain and install. At the same time, due to the limited heat removal capacity of reaction heat, the reactor volume is usually relatively small. Generally speaking, the tubular method is mostly used in large-scale plants, while the kettle method is used in plants producing special grades and high value-added products such as EVA with high vinyl acetate content. Due to the characteristics of different processes, the product of kettle process has more branched chains and better impact strength, which is suitable for extrusion coating resin. The product prepared by the tubular method has wide molecular weight distribution, few branched chains and good optical property, and is suitable for processing into a film. Process for producing low density polyethylene by high pressure tubular method The inner diameter of the tubular reactor is generally 25 ~ 82 mm, the length is 0.5 ~ 1.5 km, the length-diameter ratio is greater than 10000:1, thin film distillation, the ratio of outer diameter to inner diameter is generally not less than 2 mm, and a water jacket is provided to remove part of the reaction heat. Up to now, the basic process flow of various tubular processes is basically the same, and various processes with different characteristics are formed due to the adoption of different reactor feeding points, different molecular weight regulators, initiators and their injection positions, as well as different auxiliary injection modes, product treatment,

amount of returned ethylene and delivery positions. Expand the full text At present, the mature tubular process technologies mainly include Lupotech T process of LyondellBasell Company, tubular process of Exxon Mobil Company and CTR process of DSM Company.

01 Lupotech T process About 60% of the production capacity of domestic low density polyethylene plants adopts LyondellBasell Lupotech T process. Reaction pressure 260 ~ 310 MPa, reaction temperature 160 ~ 330 , single pass conversion 35%, wiped film evaporator, product density 0.915 ~ 0.935 G/cm³, melt index 0.15 ~ 50 G/10 min, single line productivity 45 × 10⁴ t/a. (1) Pulse reactor technology is used, which is realized by controlling the opening of the pressure relief valve at the end of the reactor, the duration of valve opening and the switching frequency. The pulse operation improves the mixing effect in the reactor, has good reaction stability and high conversion rate, reduces the wall sticking of the reactor, improves the heat transfer coefficient, and has better heat removal effect of jacket water; (2) peroxide is taken as an initiator and is inject into different areas of a reactor at four point to form four sections of reaction areas; (3) propylene and propionaldehyde are use as molecular weight regulators and are introduce from that inlet of a primary compressor and enter the reactor along with ethylene, and the product range is wide; (4) The high-pressure circulating gas system can realize the self-cleaning dissolution dewaxing operation through sequential control to reduce the impact on the normal production operation; (5) Set up hot water station system to reduce cooling water consumption and recover the heat of polymerization reaction and high-pressure circulating gas system for other devices.

02 Exxon Mobil Tube Test Process Under The conditions of reaction pressure 250 ~ 310 MPa, reaction temperature 215 ~ 310 , conversion rate up to 40%, product density 0.918 ~ 0.934 G/cm³, melt index 0.2 ~ 50 G/ (10 min) and productivity of 50 × 10⁴ t/a per line. The process has six technical characteristics: (1) a plug-flow tubular reactor is adopted, the diameter of the reactor is gradually enlarged along the axial direction, and the gas flow rate and the pressure drop of the reactor are optimized. The reaction stability is increased, the decomposition reaction is reduced, the scaling inside the reactor is reduced, and the heat transfer efficiency of the reactor is improved; (2) that initiator is inject at multiple points along the axial direction of the reactor, so that 4 to 6 reaction zone can be formed, the conversion rate and the operation flexibility are improved, and the product range is wide; (3) propylene is generally used as a regulator to control the melt index, propionaldehyde is used as a regulator in the production of medium density grade products, the regulator is injected to the inlet of the secondary compressor through a high-pressure diaphragm pump, jacketed glass reactor ,wiped film distillation, and then enters the reactor along with ethylene; And (4) a mode of combining the forward feeding of hot ethylene and the multi-point lateral feeding of cold ethylene in the tubular reactor is adopted, so that the reaction heat is uniformly released and can be removed, the cooling load of a reactor jacket is optimized, the length of the reactor is reduced, the temperature distribution of the reactor is stable, and the ethylene conversion rate is improved. At the same time, because of multi-point lateral feeding, the forward hot ethylene feeding amount of the reactor is reduced, the heat load of the preheater at the inlet of the reactor is reduced, and the consumption of high-pressure and medium-pressure steam is reduced; (5) a closed temperature regulate water system is adopt to supply water for that reactor jacket, reaction heat is removed, the heat transfer efficiency is improved, the length of the reactor is shorten, and the conversion rate is improved by optimizing the water supply temperature of the jacket water; And (6) recover and utilizing that energy of the high pressure and high heat fluid of the exhaust gas at the top of the high pressure separator.

03 CTR process In the CTR process of DSM Company, the reaction pressure is 200 ~ 250 MPa, the reaction temperature is 160 ~ 290 , the conversion rate is 28% ~ 33.1%, and the maximum conversion rate is 38%, the density of the product is

0.919 ~ 0.928 G/cm³, and the melt index is 0.3 ~ 65 G/ (10 min). The maximum single line capacity can reach 40 × 10⁴t/a. The process has five technical characteristics: (1) non-pulse operation is adopted, that operating pressure of the reactor is low and kept constant, the flow velocity in the reactor is high, the scour effect is good, the wall sticking phenomenon is avoided, and the reactor does not need to be cleaned and descaled, thereby reducing the operating cost; (2) the pipe diameter of the reactor is kept constant, the principle of direct "one pass" is adopted, no complex side feed system is adopted, the design of the reactor and the support is simpler, and the investment is lower; (3) that jacket of the reactor is cooled by cold water, and steam can be produced as a byproduct; (4) that peroxide initiator is used, the gel component of the product is small, no catalyst is left, the environmental protection effect is good, the generated oligomer is less, and the recycle gas recovery process is simplified; (5) Good operating conditions and no pressure fluctuation during polymerization make the product quality higher, especially the film products, which have excellent optical properties and processing performance, can produce film products with a minimum film thickness of 10 μm, but the product range is narrow, and the copolymer (EVA) products with low melt index can not be produced.

Production process of low density polyethylene by autoclave method

The autoclave process uses a kettle reactor with a stirring system, the length-diameter ratio can be from 2:1 to 20:1, and the volume of the kettle reactor is mostly 0.75 to 3 m³. The reaction temperature is generally 150 ~ 300 °C, the reaction pressure is generally 130 ~ 200 MPa, and the conversion rate is 15% ~ 21%. As the kettle reactor is a thick-walled vessel, the heat transfer through the reactor wall is more limited than that of the tubular reactor, so the reaction is basically an adiabatic process, and there is no obvious heat removal from the reactor. The reaction temperature is mainly controlled by injecting cold ethylene feed at multiple points to balance the reaction heat. The reactor is equipped with an agitator driven by a motor, so that the mixture in the reactor is uniform and local hot spots are avoided. The initiator adopts organic peroxide, which can be injected at multiple points at different positions along the axial direction of the reactor to form a plurality of reaction sections with different operating temperatures, and the reaction sections have no back mixing, flexible operation and wide product range, and can produce a copolymer product EVA with a vinyl acetate content of 40%.

01 Lupotech A process

A stirred tank reactor with a volume of 1.2 m³ is used in the Lupotech A process. The raw materials and initiator are injected into the reactor at multiple points. The reaction pressure is 210 ~ 246 MPa, the highest reaction temperature is 285 °C, and the regulator is propylene or propane, which is added from the inlet of the secondary compressor. The product density is 0.912 ~ 0.951 G/cm³, the melt index is 0.2 ~ 800 G/ (10 min), the vinyl acetate content can be as high as 40%, the single conversion of the reactor is 10% ~ 21%, and the largest single line design scale can reach 12.5 × 10⁴ t/a. The Lupotech A process can not only produce extrusion coating resins with more branched chains and better impact strength, but also produce film products with wider molecular weight distribution. The melt index and density of LDPE/EVA products can be well controlled by APC control system, and uniform products can be obtained.

Sierbang Petrochemical Company, Yangzi Petrochemical Company and Shanghai Petrochemical Company have introduced this process in China, and the capacity of their plants is 10 × 10⁴t/a.

02 Exxon Mobil kettle process

The Exxon Mobil autoclave process uses a 1.5m³ multi-zone autoclave reactor designed by ourselves. The reactor has a larger aspect ratio, longer residence time, higher initiator efficiency and narrower molecular weight distribution of the product, which is conducive to the production of film products with quality similar to the tubular process. Different from the Exxon Mobil tubular process, the regulator uses isobutylene or n-butane, which is boosted to 25 ~ 30 MPa by a high-pressure diaphragm pump, injected from the inlet of the secondary compressor, and enters the reactor

together with ethylene. The pressure range of the reactor is wide, the maximum reaction pressure is 200 MPa, and the LDPE homopolymer with low melt index and the EVA copolymer with high vinyl acetate content can be produced. LDPE homopolymerized products with melt index of 0.2 ~ 150 G/ (10 min) and density of 0.910 ~ 0.935 G/cm³ can be produced by Exxon Mobil autoclave process. An ethylene-vinyl acetate copolymer (EVA) product with a melt index of 0.2 to 450 G/ (10min) and a vinyl acetate content of 35%. In China, Levima Group (formerly Shandong Haoda), with a plant capacity of 10 × 10⁴t/a, cbd crystallization equipment, and Zhongtian Co-founder, with a plant capacity of 12 × 10⁴t/a, are the main ones to introduce this process. Return to Sohu to see more Responsible Editor:. toptiontech.com

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