TECHNOLOGY

Preparation of Ultrahigh Molecular Weight Syndiotactic Styrene Polymers

OVERVIEW

The molecular weight of a polymer obtained by conventional bulk phase polymerization with metallocene catalysts is generally limited by chain transfer reactions such as monomer chain transfer, solvent chain transfer, catalyst chain transfer, and -hydride elimination. Typically techniques used to generate very high or ultrahigh molecular weight polymers like the syndiotactic styrene employ very low reaction temperature and low polymerization rate. Alternatively catalyst structures designed to suppress chain transfer reactions may also be used to increase polymer molecular weight.

Researchers at University of Maryland have discovered a novel method of generating ultrahigh molecular weight syndiotactic polystyrene using constrained geometry nanotube reactor technology where polymers grow as fibrils in narrow nanoporous reaction space over catalyst deposited solid surfaces. The complex interplay of reactive monomer diffusion and supply to active catalytic sites and, the chain transfer reactions result in reduced chain transfer and significantly increased polymer molecular weight.

Advantages
A large fraction of ultrahigh molecular weight syndiotactic styrene polymers (Molecular weight larger than 500,000 or 1,000,000) can be generated using this innovative method compared to conventional techniques that use silica as a bulk support to generate similar relatively lower molecular weight polymers (below 300,000 - 500,000) with a homogenous or heterogeneous metallocene catalysts. This method minimizes chain transfer and promotes significant increase of polymer molecular weight. Additionally it is also it utilizes a less complex and less expensive catalytic process.

Applications
1) This technology enables the engineering of ultra high molecular weight plastics with unique and customizable properties.
2) Syndiotactic Polystyrene polymers have already been tested to generate ultra high molecular weight polymers.
3) The nanotubes containing the catalysts could potentially be used to synthesize other Olefinic polymers as well providing a much global impact.
4) Unpublished studies on other polymers like polyethelene suggest that this method is applicable to other polymers as well.

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Additional Information

INSTITUTION

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PATENT STATUS

Patent(s) pending

LICENSE STATUS

Contact OTC for licensing information

CATEGORIES

- Chemical

EXTERNAL RESOURCES

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