

High Speed Melt Spinning of Fluoropolymer Fibers

Description of Technology: The present invention provides a process for melt spinning a composition comprising a highly fluorinated thermoplastic polymer or a blend of such polymers, comprising the steps of melting a composition comprising a highly fluorinated thermoplastic polymer or a blend of such polymers to form a molten fluoropolymer composition; conveying said molten fluoropolymer composition under pressure to an extrusion die of an apparatus for melt spinning; and extruding the molten fluoropolymer composition through the extrusion die to form molten filaments, said die being at a temperature of at least 450.degree. C., at a shear rate of at least 100 sec.sup.-1, and at a spinning speed of at least 500 m/min..

Patent Listing:

1. **US Patent No. 6048481**, Issued April 11, 2000, "Melt spun fluoropolymeric fibers and process for producing them"
<http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HTTOFF&p=1&u=%2Fnetahhtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=6048481.PN.&OS=PN/6048481&RS=PN/6048481>
2. **US Patent No. 6207275**, Issued March 27, 2001, "Melt spun fluoropolymeric fibers and process for producing them"
<http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HTTOFF&p=1&u=%2Fnetahhtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=6207275.PN.&OS=PN/6207275&RS=PN/6207275>
3. **US Patent No. 6919130**, Issued July 19, 2005, "High speed melt spinning of fluoropolymer fibers"
<http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HTTOFF&p=1&u=%2Fnetahhtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=6,919,130.PN.&OS=PN/6,919,130&RS=PN/6,919,130>

Market Potential: Melt spinning of thermoplastic copolymers based on tetrafluoroethylene is known. However, there is considerable economic incentive to drive fiber spinning rates ever higher for these high value polymers. One problem facing processes of melt spinning is that at high shear rates, melt fracture occurs which becomes evident as surface roughness in the extruded fibers. Since the critical shear rate for the onset of melt fracture decreases with increasing melt viscosity, ways to decrease melt viscosity have centered on raising the temperature of the melt. However, in many polymers including thermoplastic copolymers based on tetrafluoroethylene, the polymer exhibits thermal degradation before any significant decrease in melt viscosity can be achieved.

Fibers of polytetrafluoroethylene (PTFE) homopolymer are also highly valued, particularly for their chemical and mechanical properties, such as low coefficient of friction, thermal stability and chemical inertness. However, processing by melt spinning has proved elusive. Since polytetrafluoroethylene homopolymer fibers are conventionally formed by a dispersion spinning process involving many steps and complicated equipment, there is great economic incentive to find a method for melt spinning such fibers.

Benefits:

- Combination of high strength and low shrinkage

Applications:

- Garments

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