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High speed melt spinning of fluoropolymer fibers

Description of Technology: The processes and apparatus of the present invention concern melt spinning fluoropolymers into single filaments or multi-filament yams at high spinning speeds.

Patent Listing:

1. **US Patent No.** 6,667,097**,** Issued on December 23, 2003, "High speed melt spinning of fluoropolymer fibers"
http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=6,667,097.PN.&OS=PN/6,667,097&RS=PN/6,667,097
2. **US Patent No.** 6,841,243**,** Issued on December 23, 2003, "High speed melt spinning of fluoropolymer fibers"
http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=6841243.PN.&OS=PN/6841243&RS=PN/6841243

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.

In U.S. Pat. No. 3,437,725 a spinneret assembly is described having a top plate, a heating plate and a lower plate with a spacer providing air space between the top plate and the heating plate. Hollow inserts, one for each filament to be spun, are placed in the top plate and extend to the bottom face of the lower plate. Molten polymer is fed into the inserts for spinning through capillaries. An electrical heater supplies heat to maintain the lower plate, heating plate and lower portions of the inserts at a temperature at least 60.degree. C. higher than the temperature of the supplied molten polymer. Heated capillary temperatures ranging between 290 and 430.degree. C. were listed in examples for spinning polyesters. No mention is made of any fluoropolymer or temperatures needed to melt spin fluoropolymers at high spinning speeds.

Benefits:

- Method to melt spin fluoropolymers at high spinning speeds

Applications:

- Fluoropolymer fibers

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