United States Patent Office 3,743,690 Patented July 3, 1973

3,743,690

PROCESS FOR THE PRODUCTION OF MONOFILAMENTS OF POLYAMIDE 12

Hans-Peter Lys, Chur, and Kaspar Ryffel, Domat-Ems, Switzerland, assignors to Inventa AG fur Forschung und Patentverwertung, Zurich, Switzerland

No Drawing. Filed Sept. 15, 1971, Ser. No. 180,838
Claims priority, application Switzerland, Oct. 8, 1970, 14,883/70
Int. Cl. D01d 5/08
U.S. Cl. 264—178 F 7 Claims

ABSTRACT OF THE DISCLOSURE

A process for the production of monofilaments of polyamide 12 which comprises melting the polyamide 12, extruding said melted polyamide 12 through spinnerets into a cooling bath at 35–50° C. whereby a monofilament is formed and winding the monofilament so formed.

Monofilaments of polyamide 6 and 6.6 (fibre size 0.08 to 0.15 mm. diameter) are usually produced by the melt spinning process, spun with a certain dwell time in cold water and then wound via withdrawal rollers on spinning bobbins. These spinning bobbins are thereafter worked up further on drawing frames. In order to ensure troublefree stretching of the monofilaments, the following conditions must be most precisely observed:

(1) The cooling water must be as cold as possible (below 18° C.).
(2) The dwell time of the freshly spun monofilament in the cooling bath must be sufficiently long, so that the monofilament is sufficiently quenched.

Attempts at spinning polyamide 12 to a fine size by this conventional technique have heretofore failed because spining bobbins of polymide 12 which have been produced by this method can be worked up further on a drawing frame only with a large proportion of waste (40–50%). They show the following serious drawbacks:

(1) The cake becomes loose on the spinning bobbin during the unwinding.
(2) The fresh spun filament becomes lofty and shows, as a result of the swelling, an undulating appearance with indentations, which results in breaking of the filament in the drafting zone.
(3) Keeping the draw-off tension constant is made difficult as a result of the loosening of the cake on the spinning bobbin. Likewise, due to the cake being loosened, when the filament is drawn off on the drawing frame it tends to become tangled and subsequently break on the spining bobbin.

In the present invention monofilaments of polyamide 12 can be produced without the above-mentioned drawbacks by melting the polyamide 12, extruding the same through spinnerets into a cooling bath of a liquid (preferably water) and winding, if a cooling bath containing water at 35–50° C. is employed and the dwell time of the monofilament in the water bath is kept at less than 1 second.

The diameter of the monofilament obtained in this way is advantageously 0.08–0.15 mm. The temperature of the water bath should preferably be around 40° C. and the

dwell time of the monofilament in the bath is preferably about 0.4–0.5 second.

To further improve the quality of polyamide 12 monofilaments on spinning bobbins ultimately obtained, the monofilament emerging from the bath may be conveyed over a distance of about 5–12 metres, preferably about 8 metres. The monofilments are first wound without being stretched. The stretching is effected later in a second operation.

The spinning bobbins produced by the process according to the invention show the following properties:

(1) Absolutely compact bobbin structure without detachment of the cake from the bobbin core.
(2) High-lustre, non-undulating monofilament free from indentations.
(3) Troublefree working up of the monofilament without breaking on the drawing frame.

The polyamide 12 monofilaments produced in this way (diameters 0.10 and 0.12 mm.) meet all the requirements of textile testing. The proportion of waste on the drawing frame can be reduced from about 40% to less than 10% by this process, which signifies an unforeseeable considerable technical advance.

The following example illustrates the invention.

EXAMPLE

Grilamid (reg. trademark) nylon 12 granules with a relative solution viscosity in m-cresol of 1.82 were spun via a melting extruder and a geared spinning pump into monofilaments in the form of a bundle of 10 fibres (spinning head temperature: 280° C., 10-hole spinneret, 10 x 0.25 mm., supply pressure in front of the spinning pump: 50 atmospheres gauge). The 10-fibre bundle of monofilaments was spun directly into water at a temperature of 40° C. and the depth of immersion was so chosen that with a draw-off rate of 100 metres per minute a dwell time of 0.44 second for an individual filament in the warm water was obtained. After the water bath, the bundle of fibres passed over a pair of withdrawal rollers onto winding bobbins. The distance between the winding bobbins and the withdrawal rollers was 8 metres.

The unstretched filament (diameter 0.20 mm.) was then stretched on a draw-winder at a stretching ratio of 1:4.1 to the final size of 0.10 mm. diameter.

In this way, nylon 12 monofilaments with the following properties are obtained:

Spinning size (mm./100)	10.3
Breaking load (kg.)	0.40
Quality factor (kg./mm.)	48.0
Elongation at break (percent)	23.5
Knot tenacity (percent)	75.0
Shrinkage (percent)	7.3
Water content (percent)	0.90
Denier	81.2

We claim:

1. In a process for the production of monofilaments of polyamide 12 wherein the polyamide 12 is melted, then extruded through spinnerets into a cooling bath to form a monofilament and the monofilament is wound, the improvement which comprises the temperature of the cooling bath is 35 to 50° C. and the dwell time of the monofilament in the cooling bath is less than one second.

2. The process as claimed in claim 1 wherein the cooling bath contains water.

3. The process as claimed in claim 1 wherein the cooling bath contains water at approximately 40° C.

4. The process as claimed in claim 1 wherein the dwell time of the monofilament is from 0.4 to 0.5 second.

5. The process as claimed in claim 1 wherein the monofilament emerging from the cooling bath is conveyed over a distance of 5–12 meters before being wound.

6. The process as claimed in claim 1 wherein the monofilament emerging from the cooling bath is conveyed over a distance of 8 meters before being wound.

7. The process as claimed in claim 1 wherein the monofilament obtained is 0.08–0.15 mm. in diameter.

References Cited

UNITED STATES PATENTS

2,212,772	8/1940	Graves	264—178 F
2,285,552	6/1942	Afthan	264—178 F
3,577,500	5/1971	Kohler et al.	264—210 F

JAY H. WOO, Primary Examiner

U.S. Cl. X.R.

264—237