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METHOD OF IMPROVING THE TEXTILE PROPERTIES OF POLYACRYLONITRILE THREADS

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This invention relates to polyacrylonitrile type fibers, and more particularly to a method of improving the textile properties of threads and filaments spun from a solution of polyacrylonitrile or copolymers thereof.

Prior proposals of this kind included a process of improving the mechanical properties of threads or filaments spun from solutions of polyacrylonitrile or its copolymers which consisted in adding to the spinning solution, directly before it was spun, a certain quantity of polyvinylacetate. This process made it possible to produce threads or filaments devoid of the tendency to split into fibrillae, which is known to quite particularly reduce the resistivity of the threads against abrasion. In this process from 2 to 30% and preferably from 5 to 15% polyvinylacetate calculated on the solid substance content of the spinning solution were added.

I have now found that apart from this improvement of the resistivity against abrasion, I can also obtain an improvement of the feel by adding to the polyacrylonitrile or a copolymer thereof, before it is spun, in addition to the polyvinylacetate, also a certain quantity of polyvinyl ethyl ether.

I prefer adding polyvinylacetate and polyvinyl ethyl ether at the rate of 2 to 30% and preferably about 15% of the solid matter content of the spinning solution, thus allowing from 98 to 70% of such solid matter content for polyacrylonitrile. I have obtained the best effects when adding the two substances, to wit: polyvinylacetate and polyvinylethylether, in the proportion of 2 to 1 calculated on the total quantity of 2–30%.

In practicing this process there is first prepared a spinning solution of polyacrylonitrile or a coploymer thereof in a solvent, for example in dimethylformamide. To this solution a mixture of e. g. 10% polyvinylacetate and about 5% polyvinylethylether is added either in solid form or in solution, for example in dimethylformamide. The complete mixture is heated to about 110° C. and spun at about 100° C. in the usual manner.

Example 1

To 18.7 kg. polyacrylonitrile having a K-value of about 85 were added 2.2 kg. polyvinylacetate having a K-value of about 70 and 1.1 kg. polyvinylethylether having a K-value of about 50, the whole mixture being dissolved in 78 kg. dimethylformamide. This solution was dissolved under stirring in the solvent by heating to 110° C. The solution was then filtered and cooled down to 80° C. before being spun according to the dry or wet spinning process.

The K-value mentioned in this example is defined on pages 58–64 of the book by Fikentscher entitled "Cellulosechemie" (1932) and in "German Plastics Practice," a

record rewritten and amplified from the Quartermasters Reports by John M. De Bell, William C. Goggin, Walter E. Gloor, published by De Bell and Richardson, Springfield, Mass., 1946, pages 518–521.

In the dry spinning process the spinning solution was spun from a spinning nozzle having perforations of about 125 to 250 μ through a heated tube about 4 meters long. During this treatment the solvent is substantially removed from the bundle of threads by means of a hot air current of about 180° C. traversing the tube.

In the wet spinning process, the bundle of threads is caused to issue from the nozzle, for example, into a bath of glycerine heated to about 130–140° C.

The threads recovered in this process are particularly well adapted for being stretched up to twelve times their lengths. After having been shrunk again, they have a strength value of 38 Rkm. at about 20% elongation. Their resistivity against abrasion is about 6 times that of threads formed from the same material, however, without any addition as shown e. g. by the following tests.

One sample, in which no addition was made, had a geometric mean value of 65 abrasion tours.

Another sample also lacking any addition had a mean value of 80 abrasion tours.

A third sample of threads spun from a polyacrylonitrile solution to which had been added 16% polyvinylacetate and 8% polyvinylethylether had a mean value of 460 abrasion tours.

The expression "abrasion tours" points to the practice of pressing a rotating cylinder of Carborundum repeatedly against a thread and counting the number of revolutions before breakage.

The feel of the threads last mentioned was particularly soft and supple.

Example 2

17 kg. polyacrylonitrile having a K-value of about 90, 1.8 kg. polyvinylacetate having a K-value of about 70 and 1.2 kg. polyvinylethylether having a K-value of about 50 were dissolved in 80 kg. dimethylformamide and spun according to Example 1. After stretching there were obtained threads of great suppleness which had a breaking strength of up to 40 Rkm. at an elongation of 20–25%. These threads had a very soft feel.

Various changes may be made in the steps described in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

I claim:

1. The method of improving the textile properties of threads of polyacrylonitrile type polymers, which comprises dissolving from 98 to 70 percent by weight of polyacrylonitrile, and from 2 to 30 percent by weight of a mixture in the proportion of from 2:1 to 1.5:1, of polyvinylacetate and polyvinylethylether, in dimethylformamide, and spinning the solution thus obtained.

2. The method of improving the textile properties of threads of polyacrylonitrile type polymers, which comprises dissolving about 85 percent by weight of polyacrylonitrile, and about 15 percent by weight of a mixture in the proportion of from about 2:1, of polyvinylacetate and polyvinylethylether, in dimethylformamide, and spinning the solution thus obtained.

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