Claims

1. Plant (100) for producing a hollow fibre, in particular a spun hollow fibre, from at least one polymer solution (102), comprising a control and regulation unit (130), a media reserve and supply unit (140), a spinning unit (106) for forming the fibre (110), wherein downstream of the spinning unit (106) for the treatment of the fibre (110) at least the following plant units are included, in the stated sequence:
   a. an exchange unit for solvent exchange (240), in particular comprising a (first) fixing unit (150), in which the fibre directly after the spinning unit (106) can be introduced or conducted through, and advantageously comprising at least one washing unit (160) downstream of the fixing unit (150),
   b. at least one post-treatment unit (170) comprising
      a thermal treatment unit (200) with at least one thermal treatment station,
      characterized in that
      at least one thermal treatment station of the thermal treatment unit (200) is provided downstream of the exchange unit (240) and is designed as a heat treatment station (250) comprising at least one heat treatment oven (251), and wherein the at least one heat treatment oven (251) comprises at least one heating element (252) and/or an inlet for a heating medium, wherein the fibre (110) can be conducted through and/or accommodated at least temporarily in the at least one heat treatment oven (251), and wherein the heat treatment oven (251) is designed to heat the at least temporarily accommodated and/or conductable fibre (110) for a defined period of time up to a (limiting) temperature that is below the glass softening temperature (T_G), in the range of:
      i) up to 80°C below the glass softening temperature (T_G), and/or
      ii) greater than 250°C, and wherein the heat treatment station (250) and/or the heat treatment oven (251) is designed in particular to subject the fibre (110) to continuous heat treatment.

2. Plant according to Claim 1, characterized in that
   i) the heat treatment space of the heat treatment oven (251) is open to the atmosphere during operation as intended, and/or
   ii) there is at least one gas inlet opening for regulated (active) introduction of gas into the heat treatment space.

3. Plant according to either of the preceding claims, characterized in that the heat treatment oven (251) is designed, for the at least temporarily accommodated and/or conductable fibre (110), i) to heat it for a defined time up to a limiting temperature of not more than 1°C to 4°C below the glass softening temperature (T_G).

4. Plant according to any of the preceding claims, characterized in that the thermal treatment unit (200) as a further thermal treatment station comprises a drying station (210) upstream of the heat treatment station (250), through which the individual fibres (110) can be conducted as a strand, wherein the drying station (210) comprises
   a. - at least one drying element and/or
   b. - a feed conduit and a drain conduit for a drying medium, such as in particular a heated gas, and

   whereby the interior of the drying station (210) can be heated at least to a temperature of over 30°C, advantageously of over 40°C and ideally of over 50°C, wherein the interior is heatable at maximum to 200°C.

5. Plant according to any of the preceding apparatus claims, characterized in that the thermal treatment unit (200) as a further thermal treatment station comprises a dehumidification station (220) upstream of the heat treatment station (250) in which the individual fibres (110) are conducted through at a distance from one another transversely to axial direction (longitudinal fibre axis (A_F)), and which comprises at least one nozzle element (222) which is directed onto the path of at least one individual fibre (110), and by means of which a gas jet can be guided onto at least one individual fibre (110), in particular a group of individual fibres (110).

6. Plant according to any of the preceding apparatus claims, characterized in that
   i) a grouping station (260) of the grouping unit is arranged upstream of the heat treatment station (250),
   ii) the heat treatment station (250) is arranged within a grouping unit, and/or
   iii) is arranged between two grouping stations (260) of a grouping unit, wherein
   in the grouping station (260) there is at least one grouping means by means of which at least one group of n individual fibres (110) can be arranged in mutual contact as bundles (112), wherein n is an integer value of from 2 to 180, preferably from 20 to 150, ideally from 30 to 120, optionally up to n = 600.

7. Plant according to any of the preceding apparatus claims, characterized in that the heat treatment station (250) comprises a ventilation unit (290) or is connected to a ventilation unit (290) and/or the heat treatment oven (251) has at least one gas inlet opening, in particular a gas inlet opening for air.

8. Plant according to any of the preceding apparatus claims, characterized in that the heating element (252) and/or the heating gas, in particular the resistance heater, has a power of
   - at least 7.5 kW/m, advantageously at least 10 kW/m and ideally at least 15 kW/m, and
   - of not more than 100 kW/m, advantageously of not more than 50 kW/m,

ideally of not more than 35 kW/m.

9. Plant according to any of the preceding apparatus claims, characterized in that the heat treatment oven (251) has a tube-, channel- or alley-like configuration, comprising at least two walls or wall portions, in particular parallel to the longitudinal fibre axis (A_F).

10. Plant according to any of the preceding apparatus claims, characterized in that the at least one heat treatment station (250) comprising the heat treatment oven (251) is positioned at one of the following plant sites:
    a. downstream of the washing unit (160), wherein no (further) thermal treatment station of the thermal treatment unit (200) is arranged ahead of the heat treatment station (250),
    b. downstream of at least one dehumidification station (220) of a thermal treatment unit (200),
    c. downstream of at least one drying station, in particular downstream of a drying station which is arranged downstream of a coating station or application unit.

11. Plant according to any of the preceding apparatus claims, characterized in that an end-processing unit (180) is positioned downstream of the heat treatment station (250).

12. Plant according to any of the preceding apparatus claims, characterized in that a fibre accumulator (230) is positioned upstream of the heat treatment station (250).

13. Plant according to any of the preceding apparatus claims, characterized in that it is designed to transport the fibre (110) continuously from the spinning unit (106) to at least the outlet of the heat treatment station (250).

14. Plant according to any of the preceding apparatus claims, characterized in that the post-treatment unit (170) comprises a coating station (120) and/or a discharging station (190).

15. Process for producing a fibre (110) which is spun from a polymer solution (102), in particular for the parallel production of m (individual) fibres (110), comprising the following steps:
    - the step of spinning the fibre (110) from the polymer solution (102),
    - exchange step for exchange of a solvent, wherein the exchange step may comprise at least one fixing step with a liquid fixing medium and/or at least one washing step in/with a washing medium, in particular in a tank with a washing medium,
    - drying step comprising a heat treatment step in which the fibre (110) is heated to a temperature below the glass softening temperature (T_G), **characterized in that**

the fibre (110) is continuously heated in the heat treatment step by means of at least one heating element (252) and/or a heating medium in a heat treatment oven (251) to a temperature
i) in the range up to 80°C below the glass softening temperature (T_G), and/or
ii) in the range of greater than 250°C and below the glass softening temperature (T_G).

16. Process according to Claim 15, characterized in that, in the heat treatment step, n individual fibres are subjected to parallel heat treatment, where n =< 600, preferably n =< 180, especially preferably n =< 120, ideally n <= 100.

17. Process according to Claim 16, characterized in that, in the heat treatment step, n individual fibres are subjected to parallel heat treatment, where n >= 2, preferably n >= 10, especially preferably n >= 20, ideally n >= 40.

18. Process according to any of the preceding process claims, characterized in that the heat treatment time is in the range of 0.5 to 60 s, preferably 1 to 30 s, ideally 1 to 20 s.

19. Process according to any of the preceding process claims, characterized in that a cooling gas is supplied, which cools at least part of the heat treatment oven (251) in the heat treatment step, where the cooling gas flows through the heat treatment oven (251) with a gas exchange frequency (AF) of 0.15 per minute (0,0025 pro sec; untere AF) up to 30 per minute (0,25 pro sec; obere AF) , cooling gas and where the heating energy introduced in the heat treatment oven (251) is =< 50 kJ/m.

20. Process according to any of the preceding process claims, characterized in that, in the heat treatment step, the fibre (110), for a defined period of time,
i) is heated up to a limiting temperature of not more than 1°C, in particular 4°C, below the glass softening temperature (T_G) and/or
ii) is heated to a limiting temperature in the range of 70°C to 1°C below the glass softening temperature (T_G) and/or
iii) is heated to a temperature in the range from greater than 280°C to 450°C and below the glass softening temperature (T_G).

21. Process according to any of the preceding process claims, characterized in that the heat treatment step is effected at a pressure in the range from not more than +2 bar to atmospheric pressure, preferably not more than +1 bar, preferably not more than +0.5 bar, and ideally equal to or essentially equal to atmospheric pressure.

22. Process according to any of the preceding process claims, characterized in that the cooling gas supplied to the heat treatment oven (250) in the heat treatment step is oxygen (O_2) in a concentration of not less than 5.0 mol%, especially not less than

10 mol%, preferably not less than 15 mol%, and is particularly ambient air with ~21 mol%.

23. Process according to any of the preceding process claims, characterized in that, in the heat treatment step, the fibre (110) is treated by means of the heating element (253) and/or the heating medium, based on the length of the heating element, with a power of
- at least 5.0 kW/m, preferably at least 7.5 kW/m and ideally at least 10 kW/m, and where
- the line is not more than 100 kW/m, advantageously not more than 50 kW/m and ideally not more than 35 kW/m.

24. Process according to any of the preceding process claims, characterized in that the fibre (110) is produced in a plant (100) designed according to at least one of the preceding apparatus claims 1 to 14.

25. Process according to any of the preceding process claims, characterized in that at least one group of m individual fibres (110) is formed (aligned) before the heat treatment step in a grouping step to form at least one bundle (112) of n = 5 to 600 individual fibres (110) and subsequently subjected to heat treatment as the bundle (112), wherein either
- n is less than m, such that two or more part-bundles (112) are formed, or
- n is equal to m, such that only one bundle (112) is formed.

26. Process according to any of the preceding process claims, characterized in that the fibre (110) is transported continuously from the spinning unit (106) to at least the outlet of the heat treatment station (250), in particular transported uncut.