period. Finally, the process of the invention, consisting in blending copolymers of different molecular weights, makes it possible to carry out the annealing necessary to structure the block copolymers at temperatures lower by 30 to 50°C with respect to the temperature used when just one block copolymer exhibiting the same period that the blended copolymers of low dispersity (typically less than 1.1) is used, or in shorter times.

These advantages are also transposable to blends of block copolymers formed in the form of objects, obtained, for example, by injection into a mold or extrusion in the form of sheets. This makes possible precise refining of the optical, acoustic or mechanical properties and the achievement of a compromise in combined properties, such as good transparency and high impact strength.

Summary:

There is provided a process for controlling the period of a nanostructured assemblage of a blend of block copolymers, this blend comprising n block copolymers with different molecular weights but for which at least one of the constituent monomers respectively of each of the blocks of the block copolymers is identical, n being a whole number between 2 and 5, comprising the following stages:

-- blend comprising block copolymers in solution,

- deposition of this solution of blend on a surface or in a mold,

- annealing.

In an aspect, there is provided a process for controlling the period of a nanostructured assemblage of a blend of block copolymers, this blend comprising n block copolymers with different molecular weights but for which at least one of the constituent monomers respectively of each of the blocks of the block copolymers is identical, n being a whole number between 2 and 5, comprising the following stages:

- blend comprising block copolymers in solution,
- deposition of this solution of blend on a surface or in a mold,
- annealing,

in which the period, expressed in nm, follows the following equation:

$$L0 = \frac{\sum_{i=1}^{n} f_i \, X \, L0_i}{\sum_{i=1}^{n} f_i}$$

where f_i being the volumic fraction of the i block copolymer in the i solution and $L0_i$ being the period of the i block copolymer after solvent evaporation, the fraction by volume f_i being defined by the IUPAC as being the volume of the component *i* in the i solution divided by the sum of the volumes of all the components in solution used to manufacture this blend.

In another aspect, there is provided the use of the process as defined above to generate lithography objects, masks or nanostructured film at nanometer scale.

In another aspect, there is provided a lithography object or mask obtained by the use as defined above.

Claims

1 A process for controlling the period of a nanostructured assemblage of a blend of block copolymers, this blend comprising n block copolymers with different molecular weights but for which at least one of the constituent monomers respectively of each of the blocks of the block copolymers is identical, n being a whole number between 2 and 5, comprising the following stages:

- blend comprising block copolymers in solution,

- deposition of this solution of blend on a surface or in a mold,

- annealing,

in which the period, expressed in nm, follows the following equation:

$$L0 = \frac{\sum_{i=1}^{n} f_i \, X \, L0_i}{\sum_{i=1}^{n} f_i}$$

where f_i being the volumic fraction of the i block copolymer in the i solution and $L0_i$ being the period of the i block copolymer after solvent evaporation, the fraction by volume f_i being defined by the IUPAC as being the volume of the component *i* in the i solution divided by the sum of the volumes of all the components in solution used to manufacture this blend.

2 The process as claimed in claim 1, exhibiting a minimum of defects of orientation, of coordination number or of distance and large monocrystalline surfaces.

3 The process as claimed in claim 1 or 2, in which n is equal to 2.

4 The process as claimed in claim 1 or 2, in which the difference in period of the block copolymers is between 25 and 40 nm, limits included.

5 The process as claimed in claim 1 or 2, in which the difference in period of the block copolymers is between 1 and 25 nm, limits included.

6 The process as claimed in claims 4 and 5, in which the block copolymers are diblock copolymers.

7 The process as claimed in claim 6, in which the block copolymers comprise a styrene monomer.

8 The process as claimed in claim 6, in which the block copolymers comprise a methacrylic monomer.

9 The process as claimed in claim 6, in which the block copolymers are PS-PMMA copolymers.

10 The process as claimed in claim 1 or 2, in which the number-average molecular weights of the block copolymers are between 1000 and 300 000 g/mol.

11 The process as claimed in claim 6, in which the proportion by weight of a block copolymer in the blend of block copolymers varies from 1% to 99%.

12 The process as claimed in claim 1 or 2, in which the block copolymers are prepared by controlled radical polymerization.

13 The process as claimed in claim 12, in which nitroxide mediated radical polymerization is carried out.

14 The process as claimed in claim 13, in which nitroxide mediated radical polymerization is carried out, the nitroxide being N-(tert-butyl)-1-diethylphosphono-2,2-dimethylpropyl nitroxide.

15 The process as claimed in claim 1 or 2, in which the block copolymers are prepared by anionic polymerization.

16 The process as claimed in claim 1 or 2, in which the block copolymers are prepared by ring opening polymerization.

17 The process as claimed in claim 1 or 2, which makes it possible to obtain films, the thickness of which is greater than 10 nm and less than 400 nm.

18 The process as claimed in claim 1 or 2, which makes it possible to obtain films, the thickness of which is greater than 40 nm and less than 400 nm.

19 The process as claimed in claim 1 or 2, in which the surface is free.

20 The process as claimed in claim 1 or 2, in which the surface exhibits guidance structures.

21 The process as claimed in claim 1 or 2, in which the annealing is carried out by a heat treatment.

22 The process as claimed in claim 1 or 2, in which the annealing is carried out by a solvent vapor treatment.

23 The process as claimed in claim 1 or 2, in which the annealing is carried out by a combination of a heat treatment and a solvent vapor treatment.

24 The process as claimed in claim 1 or 2, in which the block copolymers exhibit a dispersity of between 1 and 3.

25 The use of the process as claimed in any one of the preceding claims to generate lithography objects, masks or nanostructured film at nanometer scale.

26 A lithography object or mask obtained according to claim 25.