characterized by a contact angle of a drop of water of less than 20°, preferably of less than 10°.

In one aspect, there is provided a treatment process for enhancing the hydrophilic properties of a glass material, characterized in that it consists of an ion bombardment where: - the ions of the ion beam are selected from the ions of the elements of the list consisting of nitrogen (N) and oxygen (O); - the acceleration voltage, AV, of the ions is ~~greater than or equal to 5 kV and less than or equal to 1000 kV , in particular greater than or equal to 5 kV and less than or equal to 200 kV, indeed even~~ greater than or equal to 10 kV and less than or equal to 100 kV; - the temperature of the glass material is less than or equal to the glass transition temperature; - the dose of ions per unit of surface area is located within a range of between 5.10^{15} ions/cm^2 and 10^{18} ions/cm^2~~10^{12} ions/cm^2 and 10^{18} ions/cm^2~~, in particular ~~of greater than or equal to 10^{15} ions/cm^2, indeed even of greater than or equal to 10^{15} ions/cm^2 and~~ less than or equal to 10^{17} ions/cm^2.

In another aspect, there is a provided a glass part comprising at least one hydrophilic surface treated as described herein.

In another aspect, there is provided the use of the hydrophilic treatment process as described herein in order to treat a bulk glass part chosen from the list consisting of a motor vehicle windshield, a spectacle lens, a lens of an optical device, a mirror, a window of a building, an optical fiber and a glass syringe body.

The choice of the ions and of the conditions of bombardment of these ions according to the invention makes it possible to advantageously obtain an increase in the hydrophilicity of the glass material which is expressed by a reduction in the contact angle and an increase in the

CLAIMS

1. A treatment process for enhancing the hydrophilic properties of a glass material, characterized in that it consists of an ion bombardment where:

- the ions of the ion beam are selected from the ions of the elements of the list consisting of nitrogen (N) and oxygen (O);

- the acceleration voltage, AV, of the ions is greater than or equal to 10 kV and less than or equal to 100 kV;

- the temperature of the glass material is less than or equal to the glass transition temperature;

- the dose of ions per unit of surface area is located within a range of between 5.10^{15} ions/cm^2 and 10^{18} ions/cm^2, in particular less than or equal to 10^{17} ions/cm^2.

2. The hydrophilic treatment process as claimed in claim 1, characterized in that the dose of ions per unit of surface area and the acceleration voltage of the ions are determined so that the surface atomic concentration is greater than or equal to an atomic concentration threshold of 0.1% for nitrogen and an atomic concentration threshold of 2.5% for oxygen.

3. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the ions of the ion beam are nitrogen (N), the acceleration voltage AV is greater than or equal to 10 kV and the dose of ions per unit of surface area is greater than or equal to a value DNmin = $(AV/20)^2$, where DNmin is expressed in 10^{16} ions/cm^2 and the acceleration voltage AV is expressed in kV.

4. The hydrophilic treatment process as claimed in any one of claims 1 to 2, characterized in that the ions of the ion beam are oxygen (O), the acceleration voltage AV is greater than or equal to 10 kV and the dose of ions per unit of surface area is greater than or equal to a value DOmin = $10.(AV/20)^{1.5}$, where DOmin is expressed in 10^{16} ions/cm^2 and the acceleration voltage AV is expressed in kV.

5. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the hydrophilic treatment process of the invention comprises a preliminary stage where the dose of ions per unit of surface area and the acceleration voltage of the ions are determined according to the following stages:

a. an acceleration voltage of the ions between 10 kV and 100 kV is chosen;

b. a dose of ions per unit of surface area of between 5.10^{15} ions/cm^2 and 10^{17} ions/cm^2 is chosen;

c. a treatment according to the invention is carried out under the conditions chosen;

d. the contact angle of a drop of water on the glass material thus treated is measured;

e. the measured contact angle is compared with a desired value for contact angle;

f. if the measured contact angle is greater than the desired value for contact angle, a treatment according to the invention is again carried out with a dose of ions per unit of surface area double that previously used;

g. stages c to f are repeated until determining the dose of ions per unit of surface area and the acceleration voltage of the ions in order to obtain a measured contact angle less than or equal to the desired value for contact angle.

6. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the glass material is movable with respect to the ion beam at a rate, R_{FP}, of between 0.1 mm/s and 1000 mm/s.

7. The hydrophilic treatment process as claimed in the preceding claim, characterized in that the same region of the glass material is moved under the ion beam according to a plurality, N, of passes at the rate R_{FP}.

8. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the glass material is chosen from the list of the soda-lime glasses.

9. A glass part comprising at least one hydrophilic surface treated as claimed in any one of the preceding claims.

10. The use of the hydrophilic treatment process as claimed in any one of claims 1 to 8 in order to treat a bulk glass part chosen from the list consisting of a motor vehicle windshield, a spectacle lens, a lens of an optical device, a mirror, a window of a building, an optical fiber and a glass syringe body.

CLAIMS

1. A treatment process for enhancing the hydrophilic properties of a glass material, characterized in that it consists of an ion bombardment where:

- the ions of the ion beam are selected from the ions of the elements of the list consisting of nitrogen (N) and oxygen (O);

- the acceleration voltage, AV, of the ions is greater than or equal to 5 kV and less than or equal to 1000 kV , in particular greater than or equal to 5 kV and less than or equal to 200 kV, indeed even greater than or equal to 10 kV and less than or equal to 100 kV;

- the temperature of the glass material is less than or equal to the glass transition temperature;

- the dose of ions per unit of surface area is located within a range of between 10^{12} ions/cm^2 and 10^{18} ions/cm^2, in particular of greater than or equal to 10^{15} ions/cm^2, indeed even of greater than or equal to 10^{15} ions/cm^2 and less than or equal to 10^{17} ions/cm^2.

2. The treatment process for lastingly strengthening the hydrophilic treatment as claimed in the preceding claim, characterized in that the glass material forms the subject of a pretreatment consisting of an ion bombardment, where:

- the ions of the ion beam are selected from the ions of the elements of the list consisting of argon (Ar), krypton (Kr) and xenon (Xe);

- the acceleration voltage of the ions is greater than or equal to 5 kV and less than or equal to 1000 kV;

- the temperature of the glass material is less than or equal to the glass transition temperature;

- the dose of ions per unit of surface area is chosen within a range of between 10^{12} ions/cm^2 and 10^{18} ions/cm^2.

3. The process as claimed in claim 2, characterized in that the dose range for the argon (Ar) ions is between 5×10^{16} and 5×10^{17} ions per cm^2 in order to lastingly strengthen the hydrophilic properties.

4. The process as claimed in claim 2, characterized in that the dose range for the krypton (Kr) ions is between 10^{16} and 10^{17} ions per cm^2 in order to lastingly strengthen the hydrophilic properties.

5. The process as claimed in claim 2, characterized in that the dose range for the xenon (Xe) ions is between 5×10^{15} and 5×10^{16} ions per cm^2 in order to lastingly strengthen the hydrophilic properties.

6. The hydrophilic treatment process as claimed in claim 1, characterized in that the dose of ions per unit of surface area is chosen within a range of between 5×10^{15} ions/cm^2 and 10^{18} ions/cm^2 in order to reduce the contact angle of a drop of water below a value of less than or equal to 20°.

7. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the dose of ions per unit of surface area and the acceleration

voltage of the ions are determined so that the surface atomic concentration is greater than or equal to an atomic concentration threshold of 0.1% for nitrogen and an atomic concentration threshold of 2.5% for oxygen.

8. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the ions of the ion beam are nitrogen (N), the acceleration voltage AV is greater than or equal to 10 kV and the dose of ions per unit of surface area is greater than or equal to a value $DNmin = (AV/20)^2$, where DNmin is expressed in 10^{16} ions/cm^2 and the acceleration voltage AV is expressed in kV.

9. The hydrophilic treatment process as claimed in any one of claims 1 to 7, characterized in that the ions of the ion beam are oxygen (O), the acceleration voltage AV is greater than or equal to 10 kV and the dose of ions per unit of surface area is greater than or equal to a value $DOmin = 10.(AV/20)^{1.5}$, where DOmin is expressed in 10^{16} ions/cm^2 and the acceleration voltage AV is expressed in kV.

10. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the hydrophilic treatment process of the invention comprises a preliminary stage where the dose of ions per unit of surface area and the acceleration voltage of the ions are determined according to the following stages:

a. an acceleration voltage of the ions between 10 kV and 100 kV is chosen;

b. a dose of ions per unit of surface area of between 10^{15} ions/cm^2 and 10^{17} ions/cm^2 is chosen;

c. a treatment according to the invention is carried out under the conditions chosen;

d. the contact angle of a drop of water on the glass material thus treated is measured;

e. the measured contact angle is compared with a desired value for contact angle;

f. if the measured contact angle is greater than the desired value for contact angle, a treatment according to the invention is again carried out with a dose of ions per unit of surface area double that previously used;

g. stages c to f are repeated until determining the dose of ions per unit of surface area and the acceleration voltage of the ions in order to obtain a measured contact angle less than or equal to the desired value for contact angle.

11. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the glass material is movable with respect to the ion beam at a rate, R_{FP}, of between 0.1 mm/s and 1000 mm/s.

12. The hydrophilic treatment process as claimed in the preceding claim, characterized in that the same region of the glass material is moved under the ion beam according to a plurality, N, of passes at the rate R_{FP}.

13. The hydrophilic treatment process as claimed in any one of the preceding claims, characterized in that the glass material is chosen from the list of the soda-lime glasses.

14. A glass part comprising at least one hydrophilic surface treated as claimed in any one of the preceding claims.

15. The use of the hydrophilic treatment process as claimed in any one of claims 1 to 13 in order to treat a bulk glass part chosen from the list consisting of a motor vehicle windshield, a spectacle lens, a lens of an optical device, a mirror, a window of a building, an optical fiber and a glass syringe body.