What is claimed is:

1. A method for manufacturing a glass blank for magnetic disk, the method comprising a forming process of press-forming a lump of molten glass using a pair of dies to obtain a sheet glass blank , wherein the forming process includes controlling a difference in temperature in a press forming surface of the die so that amount of heat exhausted from a central portion of the press forming surface of the die is larger than that from the circumferential edge portion of the press forming surface, and forming the sheet glass blank having surface waviness equal to 30 nm or less.

2. The method for manufacturing a glass blank for magnetic disk according to claim 1, wherein the forming process includes reducing the difference in temperature in the press forming surface by heat-exhausting from the press forming surface and/or heating the press forming surface.

3. The method for manufacturing a glass blank for magnetic disk according to claim 1 or 2, wherein the forming process includes controlling the difference in temperature in the press forming surface by using a heat sink.

4. The method for manufacturing a glass blank for magnetic disk according to claim 3, wherein the heat sink is provided on at least a part of the surface opposite to the press forming surface.

5. The method for manufacturing a glass blank for magnetic disk according to any one of claims 1 to 4, wherein in the forming process, the falling lump of molten glass is press-formed using the pair of dies from a direction orthogonal to the falling direction.

6. The method for manufacturing a glass blank for magnetic disk according to any one of claims 1 to 5, wherein in the forming process, press forming is performed so that the temperature of the press forming surface of the pair of dies is substantially the same.

7. The method for manufacturing a glass blank for magnetic disk according to any one of claims 1 to 6, wherein the thermal expansion coefficient at 100°C to 300°C of a glass blank obtained after press forming is in a range of 30 to 100 $\times 10^{-7}(K^{-1})$.

8. The method for manufacturing a glass blank for magnetic disk according to any one of claims 1 to 7, surface roughness of the press forming surface of the die is substantially uniform throughout the surface.

9. A method for manufacturing a glass substrate for magnetic disk, wherein a glass blank for magnetic disk is subjected to polishing processing having machining allowance of 50 μm or less to manufacture a glass substrate for magnetic disk, the glass blank being manufactured with the method for manufacturing a glass blank for magnetic disk according to any one of claims 1 to 8.

10. A method for manufacturing a glass substrate for magnetic disk, wherein a glass substrate for magnetic disk is manufactured using a glass blank for magnetic disk, the glass blank being obtained with the method for manufacturing a glass blank for magnetic disk according to any one of claims 1 to 8.

11. A method for manufacturing a glass blank for magnetic disk, the method comprising a forming process of press-forming a lump of molten glass using a pair of dies to obtain a sheet glass blank , wherein in the forming process, press forming is performed to form the sheet glass blank while temperature of the molten glass is controlled so that cooling rate of the molten glass is -10 °C/second or less in the period during the period of time in which the molten glass is cooled from a glass transition point (Tg) to a strain point, wherein the sheet glass is to be scribed into two-concentric-circle shape having outside concentric circle and inside concentric circle, and the sheet glass blank is to be partially heated so that a portion outside the outside concentric circle and a portion inside the inside concentric circle are removed by a difference in thermal expansion of the sheet glass blank.

12. A method for manufacturing a glass blank for magnetic disk, the method comprising a forming process of press-forming a lump of molten glass using a pair of dies to obtain a sheet glass blank , wherein in the forming process, press forming is performed to form the sheet glass blank while cooling rate of the molten glass is controlled during the period of time in which the molten glass is cooled from a glass transition point to a strain point so as to reduce in-plane strain generated when the molten glass lump is solidified into a sheet glass blank, wherein the sheet glass blank is to be scribed into two-concentric-circle shape having outside concentric circle and inside concentric circle, and the sheet glass blank is to be partially heated so that a portion outside the outside concentric circle and a portion inside the inside concentric circle are removed by a difference in thermal expansion of the sheet glass blank.

13. A method for manufacturing a glass blank for magnetic disk, which includes a forming process of press-forming a lump of molten glass using a pair of dies to obtain a sheet glass blank, wherein in the forming process, press forming is performed to form the sheet glass blank while cooling rate of the molten glass is controlled so that a difference in temperature on a surface of the molten glass during pressing of the molten glass is reduced, wherein the sheet glass blank is to be scribed into two-concentric-circle shape having outside concentric circle and inside concentric circle, and the sheet glass blank is to be partially heated so that a portion outside the outside concentric circle and a potion inside the inside concentric circle are removed by a difference in thermal expansion of the sheet glass blank.

14. The method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 13, wherein press forming is performed while the cooling rate of the molten glass is controlled

so that a difference in temperature on a surface of the molten glass is reduced during the period of time in which the pair of dies close and separate.

15. The method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 14, wherein in the forming process, press forming is performed while the cooling rate of the molten glass is controlled so that a difference in temperature on a surface of the molten glass is reduced during the period of time in which the temperature of the molten glass moves from a glass transition point (Tg) to a strain point while pressing of the molten glass.

16. The method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 15, wherein in the forming process, the falling lump of molten glass is press-formed using the pair of dies from a direction orthogonal to the falling direction.

17. The method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 16, wherein in the forming process, press forming is performed while temperature of a press forming surface of the die during pressing of the molten glass is kept substantially uniform.

18. The method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 17, wherein in the forming process, press forming is performed so that temperature of a press forming surface of the die is substantially identical between the pair of dies.

19. The method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 18, wherein the temperature of the pair of dies is kept lower than the glass transition point (Tg) of the molten glass during the period of time in which the glass blank starts to contact and is separated from the die.

20. The method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 19, wherein the forming process is performed using a molten glass having a glass transition point (Tg) of 600°C or higher.

21. A method for manufacturing a glass blank for magnetic disk, the method comprising a forming process of press-forming a lump of molten glass using a pair of dies to obtain a sheet glass blank , wherein in the forming process, press forming is performed to form the sheet glass blank while temperature of the molten glass is controlled so that surface waviness of the sheet glass blank is 30 nm or less and the cooling rate is -10 °C/second or less during the period of time in which the temperature of the molten glass is cooled from a glass transition point to a strain point, wherein the sheet glass blank is to be scribed into two-concentric-circle shape having outside concentric circle and inside concentric circle, and the sheet glass blank is to be partially heated so that a portion outside the outside concentric circle and a portion inside the inside concentric circle are removed by a difference in thermal expansion of the sheet glass blank.

22. A method for manufacturing a glass substrate for magnetic disk, wherein a glass substrate for magnetic disk is manufactured without performing annealing treatment using a glass blank for magnetic disk, the glass blank being obtained with the method for manufacturing a glass blank for magnetic disk according to any one of claims 11 to 21.

23. A glass substrate for magnetic disk, which is obtained with the method for manufacturing a glass substrate for magnetic disk according to claim 22, wherein the glass transition point (Tg) is 600°C or higher.

24. A magnetic disk which is manufactured using the glass substrate for magnetic disk which is obtained with the method for manufacturing a glass substrate for magnetic disk according to claim 22.

What is claimed is:

1. A method for manufacturing a glass blank for a magnetic disk, the method comprising:

cutting a lump of molten glass from flowing molten glass to cause the lump of molten glass to fall; and

a forming process of press-forming the lump of molten glass using first and second dies each having a plate shape, such that during the forming process, the falling lump of molten glass is press-formed using the first and second dies from a direction orthogonal to a falling direction of the lump of molten glass so that respective press forming inner circumferential surfaces of the first and second dies contact the lump of molten glass at substantially the same time to spread the lump of molten glass along the inner circumferential surfaces of the first and second dies to produce the glass blank having a plate shape, a time from when the lump of molten glass comes into contact with the press forming inner circumferential surface of the first die or the press forming inner circumferential surface of the second die to a time when the lump of molten glass is completely confined between the first and second dies is 0.1 second or less, and a temperature difference along each of the press forming surfaces of the pair of dies is maintained at 10°C or less so that a surface waviness of the glass blank is equal to 30 nm or less and is measured as a maximum elevation difference in wavelength component of 5 mm or less with respect to a principal surface of the glass blank.

2. The method for manufacturing a glass blank for a magnetic disk according to claim 1, further comprising a thermal equalizer configured to reduce the temperature difference along each of the press forming surfaces heat-exhausting from the press forming surfaces and/or heating the press forming surfaces.

3. The method for manufacturing a glass blank for a magnetic disk according to claim 1 or 2, wherein the thermal equalizer comprises a heat sink.

4. The method for manufacturing a glass blank for a magnetic disk according to claim 3, wherein the heat sink is provided on at least a part of a respective surface opposite to a respective one of press forming surfaces.

5. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 1 to 4, wherein the heat sink is provided so that amount of heat exhausted from a central portion of the molten glass is larger than that from a

circumferential edge portion of the molten glass during the press forming.

6. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 1 to 5, wherein in the forming process, press forming is performed so that the temperature of the press forming surface of the pair of dies is substantially the same.

7. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 1 to 6, wherein a thermal expansion coefficient at 100°C to 300°C of a glass blank obtained after press forming is in a range of 30 to 100 $\times 10^{-7}(K^{-1})$.

8. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 1 to 7, surface roughness of the press forming surface of the die is substantially uniform throughout the surface.

9. A method for manufacturing a glass substrate for a magnetic disk, wherein a glass blank for magnetic disk is subjected to polishing processing having machining allowance of 50 μm or less to manufacture a glass substrate for magnetic disk, the glass blank being manufactured with the method for manufacturing a glass blank for magnetic disk according to any one of claims 1 to 8.

10. A method for manufacturing a glass blank for a magnetic disk, the method comprising:

cutting a lump of molten glass from flowing molten glass to cause the lump of molten glass to fall; and

a forming process of press-forming the lump of molten glass using first and second dies each having a plate shape, such that during the forming process, the falling lump of molten glass is press-formed using the first and second dies from a direction orthogonal to a falling direction of the lump of molten glass so that respective press forming inner circumferential surfaces of the first and second dies contact the lump of molten glass at substantially the same time to spread the lump of molten glass along the inner circumferential surfaces of the first and second dies to produce the glass blank having a plate shape while a temperature difference between the press forming surfaces of the pair of dies is maintained at 5°C or less and a temperature of the molten glass is controlled so that a cooling rate of the molten glass is -10 °C/second or less in a period

during a period of time in which the molten glass is cooled from a glass transition point (Tg) to a strain point, and a time from when the lump of molten glass comes into contact with the press forming inner circumferential surface of the first die or the press forming inner circumferential surface of the second die to a time when the lump of molten glass is completely confined between the first and second dies is 0.1 second or less.

11. A method for manufacturing a glass blank for a magnetic disk, the method comprising:

cutting a lump of molten glass from flowing molten glass to cause the lump of molten glass to fall; and

a forming process of press-forming a lump of molten glass using first and second dies each having a plate shape, such that during the forming process, the falling lump of molten glass is press-formed using the first and second dies from a direction orthogonal to a falling direction of the lump of molten glass so that respective press forming inner circumferential surfaces of the first and second dies contact the lump of molten glass at substantially the same time to spread the lump of molten glass along the inner circumferential surfaces of the first and second dies to produce the glass blank having a plate shape while a temperature difference between the press forming surfaces of the pair of dies is maintained at 5°C or less and a cooling rate of the molten glass is controlled during a period of time in which the molten glass is cooled from a glass transition point to a strain point so as to reduce in-plane strain generated when the molten glass lump is solidified into the glass blank, and a time from when the lump of molten glass comes into contact with the press forming inner circumferential surface of the first die or the press forming inner circumferential surface of the second die to a time when the lump of molten glass is completely confined between the first and second dies is 0.1 second or less.

12. A method for manufacturing a glass blank for a magnetic disk, the method comprising:

cutting a lump of molten glass from flowing molten glass to cause the lump of molten glass to fall; and

a forming process of press-forming the lump of molten glass using first and second dies, such that during the forming process, press forming is performed using the first and second dies from a direction orthogonal to a falling direction of the lump of

molten glass so that respective press forming inner circumferential surfaces of the first and second dies contact the lump of molten glass at substantially the same time to spread the lump of molten glass along the inner circumferential surfaces of the first and second dies to produce the glass blank having a plate shape while a temperature difference between the press forming surfaces of the pair of dies is maintained at 5°C or less and a cooling rate of the molten glass is controlled so that a difference in temperature on a surface of the molten glass during pressing of the molten glass is reduced, and a time from when the lump of molten glass comes into contact with the press forming inner circumferential surface of the first die or the press forming inner circumferential surface of the second die to a time when the lump of molten glass is completely confined between the first and second dies is 0.1 second or less.

13. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 10 to 12, wherein press forming is performed while the cooling rate of the molten glass is controlled so that a difference in temperature on a surface of the molten glass is reduced during the period of time in which the pair of dies close and separate .

14. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 10 to 13, wherein in the forming process, press forming is performed while the cooling rate of the molten glass is controlled so that a difference in temperature on a surface of the molten glass is reduced during the period of time in which the temperature of the molten glass moves from a glass transition point (Tg) to the strain point during pressing of the molten glass.

15. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 10 to 14, wherein in the forming process, press forming is performed while temperature of a press forming surface of the die during pressing of the molten glass is kept substantially uniform.

16. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 10 to 15, wherein in the forming process, press forming is performed so that temperature of a press forming surface of the die is substantially identical between the pair of dies.

17. The method for manufacturing a glass blank for a magnetic disk according to

any one of claims 10 to 16, wherein the temperature of the pair of dies is kept lower than the glass transition point (Tg) of the molten glass during a period of time beginning when the glass blank starts to contact at least one of the press forming surfaces and ending when the glass blank and is separated from the at least one of the press forming surfaces.

18. The method for manufacturing a glass blank for a magnetic disk according to any one of claims 10 to 17, wherein the forming process is performed using a molten glass having a glass transition point (Tg) of 600°C or higher.

19. A method for manufacturing a glass substrate for a magnetic disk, wherein a glass substrate for magnetic disk is manufactured without performing annealing treatment using a glass blank for magnetic disk, the glass blank being obtained with the method for manufacturing a glass blank for magnetic disk according to any one of claims 10 to 18.

20. A method for manufacturing a glass substrate for a magnetic disk according to claim 19, wherein the glass transition point (Tg) is 600°C or higher.

21. A method for manufacturing a magnetic disk, the method comprising depositing at least a magnetic layer on a principle surface of the glass substrate for a magnetic disk obtained with the method for manufacturing a glass substrate for a magnetic disk according to claim 9.

22. A method for manufacturing a glass blank for magnetic disk according to claim 1, wherein during the forming process, the difference in temperature along the press forming surface of the die is controlled based on a relation between differences in temperature in the press forming surface of the die during the forming process and corresponding sets of surface waviness of the glass blank.