thickness control problems, refractive index control problems, shape and location of a part in a vacuum chamber, gas type changing, metal type changing before making each layer, residual contamination layer after each gas and/or metal changing, treatment parameters validation before treatment of new parts.

All of the above gives rise to a need for a sapphire material treatment method to give enhanced anti-glare properties. Preferably, anti-glare properties obtained thanks to such a method should be stable over a very long term; preferably, said anti-glare properties should have good scratch-proof properties, that are for example substantially comparable or superior to those of the original synthetic sapphire material. Accordingly, said sapphire material surface treatment method may substitute anti-glare PVD coatings and even tough may lead to enhanced anti-glare results. Preferably said sapphire material surface treatment method should be suitable for easy industrialisation, so as to be able to offer such sapphire materials in a significant quantity and at reasonable costs.

The aim of the invention is that of offering a method for treating sapphire material that is open new routes; preferably, said method is not expensive or even though inexpensive and suitable for treating surfaces meeting the needs of numerous applications.

Summary

In one aspect, there is provided a treatment method of a sapphire material, said method comprising bombardment of a surface of the sapphire material, said surface facing a medium different from the sapphire material, by a single- and/or multi-charged gas ion beam so as to produce an ion implanted layer in the sapphire material, wherein:

- the dose of implanted single- and/or multi-charged gas ions per unit of surface area is chosen in a range between 10^{12} ions/cm^2 and 10^{18} ions/cm^2; and,
- the acceleration voltage is chosen in a range between 5kV and 1000 kV;

- the dose of implanted single- and/or multi-charged gas ions and the acceleration voltage are further chosen so that to obtain an anti-glare treatment in the visible range ; and,

- wherein the ions of the single- and/or multi-charged gas ions are selected from ions of the elements from the list consisting of helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), boron (B), carbon (C), nitrogen (N), oxygen (O), fluorine (F), silicon (Si), phosphorus (P) and sulphur (S).

In another aspect, there is provided a part made of synthetic sapphire material comprising at least one surface with implanted ions as disclosed herein, wherein the reflection of an incident wave in the visible range is reduced at least by one third, as for example by one half, when compared to the reflection of an incident wave in the visible range on the untreated sapphire material, such as for example a wavelength of the incident wave of 560 nm.

In yet another aspect, there is provided a use of the treatment method as disclosed herein, for treating a solid part made of synthetic sapphire material chosen from the list consisting of a screen, such as for example a touch screen, a window, a watch glass, a light emitting device (LED) part, a lighting device part, an optical component, such as for example device lens.

In a further aspect, there is provided a synthetic sapphire material comprising at least one surface with implanted ions of the elements from the list consisting of helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), boron (B), carbon (C), nitrogen (N), oxygen (O), fluorine (F), silicon (Si), phosphorus (P) and sulphur (S), wherein the reflection of an incident wave in the visible range on said surface is equal or less to 2%, as for example equal or less to 1%, when measured at a 560 nm wavelength.

In another aspect, there is provided a capacitive touch panel having a high transmission in the visible range comprising:

a) a front face made of a sapphire material where the front side of the sapphire material has been ion bombarded by using an ion beam wherein the ions are chosen from the ions of the atoms from the list consisting of helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), boron (B), carbon (C),

nitrogen (N), oxygen (O), fluorine (F), silicon (Si), phosphorus (P) and sulphur (S);

b) a capacitive touch detection layer,

c) a display screen.

Detailed Disclosure of Embodiments

For this purpose, an object of the invention is a treatment method of a sapphire material, said method comprising bombardment of a surface of the sapphire material, said surface facing a medium different from the sapphire material, by a single- and/or multi-charged gas ion beam so as to produce an ion implanted layer in the sapphire material, wherein:

- the dose of implanted single- and/or multi-charged gas ions per unit of surface area is chosen in a range between 10^{12} ions/cm^2 and 10^{18} ions/cm^2; and,
- the acceleration voltage is chosen in a range between 5kV and 1000 kV;
- the dose of implanted single- and/or multi-charged gas ions and the acceleration voltage are further chosen so that to obtain an anti-glare treatment in the visible range ; and,