CLAIMS

~~1. A blank mask comprising:~~

~~a transparent substrate;~~

~~a phase shift film disposed on the transparent substrate; and~~

~~a light shielding film disposed on the phase shift film;~~

~~wherein a TFT1 value expressed by Equation 1 below is 0.25 μm/100 °C or less;~~

~~[Equation 1]~~

$$TFT1 = \frac{\Delta PM}{T2 - T1}$$

~~where, when the thermal variation of the processed blank mask, which is formed by processing the thickness of the transparent substrate of the blank mask to be 0.6 mm and removing the light shielding film, is analyzed in a thermomechanical analyzer,~~

~~the measuring temperature of the thermomechanical analyzer is increased from the T1 to the T2, and~~

~~the ΔPM is a position change of the upper surface of the phase shift film in the thickness direction at the T2, based on a position of the upper surface of the phase shift film at the T1.~~

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~~2. The blank mask of claim 1,~~

~~wherein the TFT1 value is 0.2 μm/100 °C or less,~~

~~when the T1 is 50 °C and the T2 is 80 °C.~~

~~3. The blank mask of claim 1,~~

~~wherein the TFT1 value is 0.2 μm/100 °C or less,~~

~~when the T1 is 50 °C and the T2 is 150 °C.~~

~~4. The blank mask of claim 1,~~

~~wherein a Photon energy in a point having a Del_2 value of 0 according to Equation 3 below is 1.8 eV to 2.14 eV, when PE_1 value is 1.5 eV and PE_2 value is 3.0 eV;~~

~~[Equation 3]~~

$$Del_2 = \lim_{\Delta PE \to 0} \left(\frac{\Delta DPS}{\Delta PE} \right)$$

~~where in the Equation 3,~~

~~the DPS value is, when the light shielding film is removed from the blank mask and the surface of the phase shift film is measured with a spectroscopic ellipsometer by applying an incident angle to be 64.5 °, the phase difference between P wave and S wave of reflected light if the phase difference between the P wave and the S wave of the reflected light is 180 ° or less, or a value of subtracting the phase difference between the P wave and the S wave of the reflected light from 360 ° if the phase difference between the P wave and the S wave of the reflected light is more than 180 °, and~~

~~the PE value is the Photon energy of incident light within a range of the PE_1 value to the PE_2 value.~~

~~5. The blank mask of claim 1,~~

~~wherein a Photon energy in a point having a Del_2 value of 0 according to Equation 3 below is 3.8 eV to 4.64 eV, when PE_1 value is 3 eV and PE_2 value is 5 eV;~~

~~[Equation 3]~~

$$Del_2 = \lim_{\Delta PE \to 0} \left(\frac{\Delta DPS}{\Delta PE} \right)$$

~~where in the Equation 3,~~

~~the DPS value is, when the light shielding film is removed from the blank mask and the surface of the phase shift film is measured with a spectroscopic ellipsometer by applying an incident angle to be 64.5 °, the phase difference between P wave and S wave of reflected light if the phase difference between the P wave and the S wave of the reflected light is 180 ° or less, or a value of subtracting the phase difference between the P wave and the S wave of the reflected light from 360 ° if the phase difference between the P wave and the S wave of the reflected light is more than 180 °, and~~

~~the PE value is the Photon energy of incident light within a range of the PE_1 value to the PE_2 value.~~

~~6~~1. A blank mask comprising:

a transparent substrate;

a phase shift film disposed on the transparent substrate; and

a light shielding film disposed on the phase shift film;

wherein a Photon energy of incident light in a point having a Del_2 value of 0 according to Equation 3 below is 3.8 eV to 4.64 eV, when PE_1 value is 3.0 eV and PE_2 value is 5.0 eV;

[Equation 3]

$$Del_2 = \lim_{\Delta PE \to 0} \left(\frac{\Delta DPS}{\Delta PE} \right)$$

where in the Equation 3,

the DPS value is, when the light shielding film is removed from the blank mask and after that the surface of the phase shift film is measured with a spectroscopic ellipsometer by applying an incident angle to be 64.5 °, the phase difference between P wave and S wave of reflected light if the phase difference between the P wave and the S wave of the reflected light

is 180 ° or less, or a value of subtracting the phase difference between the P wave and the S wave of the reflected light from 360 ° if the phase difference between the P wave and the S wave of the reflected light is more than 180 °, and

the PE value is the Photon energy of incident light within a range of the PE_1 value to the PE_2 value.

~~7~~2. The blank mask of claim ~~6~~1,

wherein a Photon energy of incident light in a point having the Del_2 value of 0 is 1.8 to 2.14 eV, when the PE_1 value is 1.5 eV and the PE_2 value is 3.0 eV.

~~8~~3. The blank mask of claim ~~6~~1,

wherein an average value of the Del_2 value is 78 to 98 °/eV, when the PE_1 value is 1.5 eV and the PE_2 value is the minimum value within Photon energy values of incident light in a point having the Del_2 value of 0.

~~9~~4. The blank mask of claim ~~6~~1,

wherein an average value of the Del_2 value is -65 to -55 °/eV, when the PE_1 value is the minimum value within Photon energy values of incident light in a point having the Del_2 value of 0, and the PE_2 value is the maximum value within Photon energy values of the incident light in a point having the Del_2 value of 0.

~~10~~5. The blank mask of claim ~~6~~1,

wherein an average value of the Del_2 value is 60 to 120 °/eV, when the PE_1 value is the maximum value within Photon energy values of incident light in a point having the Del_2

value of 0, and when the PE_2 value is 5.0 eV.

~~11~~6. The blank mask of claim ~~6~~1,

wherein the maximum value of the Del_2 value is 105 to 300 °/eV, when the PE_1 value is 1.5 eV and the PE_2 value is 5.0 eV.

~~12~~7. The blank mask of claim ~~11~~6,

wherein the Photon energy in a point having the maximum value of the Del_2 value is 4.5 eV or more.

~~13~~8. The blank mask of claim 1,

wherein the phase shift film comprises a phase difference adjustment layer and a protective layer disposed on the phase difference adjustment layer,

wherein the phase shift film comprises a transition metal, silicon, oxygen and nitrogen,

wherein the phase difference adjustment layer comprises nitrogen in an amount of 40 to 60 atom%,

wherein the protective layer comprises nitrogen in an amount of 20 to 40 atom%,

wherein the protective layer comprises a region in which the ratio of nitrogen content to oxygen content in the thickness direction is 0.4 to 2, and the region has a thickness of 30 to 80% compared to a total thickness of the protective layer.

~~14~~9. The blank mask of claim ~~13~~8,

wherein the ratio of the thickness of the protective layer to the thickness of the phase shift film is 0.04 to 0.09.

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15. A photomask comprising:

a transparent substrate;

a phase shift pattern film disposed on the transparent substrate; and

a light shielding pattern film disposed on the phase shift pattern film;

wherein a TFT3 value expressed by Equation 4 below is 0.25 μm/100 °C or less;

[Equation 4]

$$TFT3 = \frac{\Delta pPM}{T2 - T1}$$

where, when the thermal variation of the processed photomask, which is formed by processing the thickness of the transparent substrate to be 0.6 mm and removing the light shielding pattern film, is analyzed in a thermomechanical analyzer,

the measuring temperature of the thermomechanical analyzer is increased from the T1 to the T2, and

the ΔpPM is a position change of the upper surface of the phase shift pattern film in the thickness direction at the T2 based on a position of the upper surface of the phase shift pattern film at the T1.