colors, low reflection energy intensity, and low reflection color brightness can be obtained, thereby meeting the application requirements of an under-screen device in the full screen of a mobile phone and an on-board device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Other features, objects, and advantages of the present disclosure will become more apparent by reading the detailed description of the non-limiting examples with reference to the accompanying drawings:

[0022] FIG. 1 is a schematic structural view of a near-infrared narrowband filter provided by an example of the present disclosure;

[0023] FIG. 2 is a flowchart of a manufacturing method of the near-infrared narrowband filter provided by an example of the present disclosure;

[0024] FIG. 3a is a diagram showing a relationship between reflectivity and wavelength of a bright reflection color narrowband filter provided in example 1 of the present disclosure;

[0025] FIG. 3b is a diagram showing a relationship between reflectivity and wavelength of a dark reflection color narrowband filter provided in example 1 of the present disclosure;

[0026] FIG. 4a is a diagram showing a relationship between reflectivity and wavelength of a bright reflection color narrowband filter provided in example 2 of the present disclosure;

[0027] FIG. 4b is a diagram showing a relationship between reflectivity and wavelength of a dark reflection color narrowband filter provided in example 2 of the present disclosure;

[0028] FIG. 5a is a diagram showing a relationship between reflectivity and wavelength of a bright reflection color narrowband filter provided in example 3 of the present disclosure;

[0029] FIG. 5b is a diagram showing a relationship between reflectivity and wavelength of a dark reflection color narrowband filter provided in example 3 of the present disclosure;

[0030] FIG. 6a is a diagram showing a relationship between reflectivity and wavelength of a bright reflection color narrowband filter provided in example 4 of the present disclosure;

[0031] FIG. 6b is a diagram showing a relationship between reflectivity and wavelength of a dark reflection color narrowband filter provided in example 4 of the present

on-board devices.

[0046] On the basis of the above example, the high refractive index layer in the near-infrared narrowband filter provided by an example of the present disclosure is formed by one or more of hydrogenated silicon, Si_xGe_{1-x} and Si_xGe_{1-x}: H, or the high refractive index germanium-based layer is formed by one or more of hydrogenated germanium, Si_xGe_{1-x}, and Si_xGe_{1-x}: H. That is, when forming the set of films with a high refractive index layer in the near-infrared narrowband filter provided by an example of the present disclosure, one or more of hydrogenated silicon, Si_xGe_{1-x} and Si_xGe_{1-x}:H may be mixed and coated to form the high refractive index layer; when forming a set of films with a high refractive index germanium-based layer, one or more of germanium hydride, Si_xGe_{1-x} and Si_xGe_{1-x}: H are mixed and coated to form the high refractive index germanium-based layer.

[0047] On the basis of the above example, the low refractive index layer in the near-infrared narrowband filter provided by an example of the present disclosure is formed by one or more of SiO_2, Si_3N_4, SiO_xN_y, Ta_2O_5, Nb_2O_5, TiO_2, Al_2O_3, SiCN and SiC. That is, one or more of SiO_2, Si_3N_4, SiO_xN_y, Ta_2O_5, Nb_2O_5, TiO_2, Al_2O_3, SiCN and SiC may be mixed and coated to form the low refractive index layers of the two set of films of the near-infrared narrowband filter provided by an example of the present disclosure.

[0048] On the basis of the above example, the near-infrared narrowband filter provided by an example of the present disclosure further includes a plurality of matching layers with a refractive index ranging from 1.7 to 4.5 in the wavelength range of 780 nm to 3000 nm. That is, the near-infrared narrowband filter provided by an example of the present disclosure further includes a plurality of matching layers.

[0049] On the basis of the above example, the middle refractive index layer in the near-infrared narrowband filter provided by an example of the present disclosure is formed by one or more of a-SiO_x:H_y, a-SiN_x:H_y, a-GeO_x:H_y, a-GeN_x:H_y, a-$Si_zGe_{1-z}O_x$:H_y and a-$Si_zGe_{1-z}N_x$: H_y. That is, one or more of a-SiO_x:H_y, a-SiN_x:H_y, a-GeO_x:H_y, a-GeN_x:H_y, a-$Si_zGe_{1-z}O_x$:H_y and a-$Si_zGe_{1-z}N_x$:H_y may be mixed and coated to form the middle refractive index layer of the near-infrared narrowband filter provided by an example of the present disclosure.

[0050] In the near-infrared narrowband filter provided by an example of the present disclosure, after the set of narrowband pass films and the set of wideband pass films or the set of longwave pass films are coated on both sides, the reflection color of the near-infrared narrowband filter may satisfy: $x < 0.509$; $y < 0.363$; and $z < 30\%$ in the CIE xyz coordinate system. That is, in the near-infrared narrowband filter provided by an example

layer. That is, when coating the substrate using the manufacturing method of the near-infrared narrowband filter provided by an example of the present disclosure, the above-mentioned two-layer film materials (high refractive index layer and low refractive index layer) may be used for coating to obtain the set of narrowband pass films and the set of wideband pass films or the set of longwave pass films. Alternatively, three-layer film materials, namely high refractive index layer, middle refractive index layer and low refractive index layer, may be used to form the set of wideband pass films or the set of longwave pass films. The method is flexible in operation and precise in coating.

[0060] On the basis of the above example, the manufacturing method of the near-infrared narrowband filter provided by an example of the present disclosure further includes: bombarding the target with a charged ion beam obtained by glow discharge based on silicon, germanium, argon, hydrogen, and oxygen to coat the middle refractive index layer, the middle refractive index layer including one or more of a-SiO_x:H_y, a-SiN_x:H_y, a-GeO_x:H_y, a-GeN_x:H_y, a-$Si_zGe_{1-z}O_x$:H_y and a-$Si_zGe_{1-z}N_x$:H_y. That is, before the glow discharge, vacuum the deposition chamber to less than 5*10^-5torr. During the glow discharge deposition process, argon gas with a flow rate of 10 sccm to 300 sccm is used as the reaction gas, and hydrogen gas with a flow rate of less than 80 sccm and oxygen gas with a flow rate of less than 60 sccm are sequentially introduced. During the hydrogenation reaction, oxygen atoms are doped into the amorphous silicon film to form new bonds with Si in the amorphous silicon to form hydrogenated amorphous silicon oxide (a-SiO_x:H_y), hydrogenated amorphous germanium oxide (a-GeO_x:H_y) and hydrogenated amorphous silicon germanium oxide (a-$Si_zGe_{1-z}O_x$:H_y), thereby obtaining the corresponding substance for coating the middle refractive index layer.

[0061] In order to better illustrate the coating structure of the near-infrared narrowband filter film sets in the present disclosure, the following examples are now provided for further description.

Example 1

[0062] A second side of a near-infrared narrowband filter provided by an example of the present disclosure may be coated with a set of wideband pass films or a set of longwave pass films. Table 1a is a table showing the layer thicknesses of the films in the set of wideband pass films or the set of longwave pass films. Table 1a reflects the layer structure of the set of wideband pass films or the set of longwave pass films of the near-infrared narrowband filter of the present disclosure. Two film materials are alternately coated with different thicknesses to form a required film set structure. In the structure shown in Table

Table 1a: Layer thickness of film in a set of wideband pass films or a set of longwave pass films, unit: nm

Layer number	1	2	3	4	5	6
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	170.6	27.72	82.96	32.7	132.4	40.69
Layer number	6	7	8	9	10	11
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	101.55	31.19	119.83	37.6	122.7	34.77
Layer number	12	13	14	15	16	17
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	116.51	34.77	118.47	30.3	127.7	42.24
Layer number	18	19	20	21	22	23
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	123.15	26.47	105.93	42.1	126.9	35.13
Layer number	24	25	26	-	-	-
Material	SiO_2	Si:H	SiO_2	-	-	-
Thickness	74.04	22.29	94.59	-	-	-

Table 1b: Layer thickness of film in a set of bright reflection color, narrowband pass films, unit: nm

Layer number	1	2	3	4	5
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-Si:H
Thickness	148.86	385.37	60.57	498.56	133.63
Layer number	6	7	8	9	10
Material	SiO_2	a-Si:H	SiO_2	a-Si:H	SiO_2
Thickness	148.47	58.19	146.02	389.75	168.05
Layer number	11	12	13	14	15
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-Si:H
Thickness	77.19	107.45	399.35	116.46	83.12
Layer number	16	17	18	19	20
Material	SiO_2	a-Si:H	SiO_2	a-Si:H	SiO_2
Thickness	125.35	404.06	54.76	98.94	130.29
Layer number	21	22	23	24	
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	
Thickness	501.89	230.75	100.12	459.47	

Table 1c: Layer thickness of film in a set of dark reflection color, narrowband pass films, unit: nm

Layer number	1	2	3	4	5
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-SiO_x:H_y
Thickness	158.5	372.09	66.79	397.77	142.05
Layer number	6	7	8	9	10
Material	SiO_2	a-Si:H	SiO_2	a-SiO_x:H_y	SiO_2
Thickness	427.94	4.81	226.16	387.64	179.16
Layer number	11	12	13	14	15
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-Si:H

Thickness	78.18	52.78	408.53	143.7	79.69
Layer number	16	17	18	19	20
Material	SiO_2	a-Si:H	SiO_2	a-Si:H	SiO_2
Thickness	93.16	415.52	54.15	77.91	191.01
Layer number	21	22	23	24	25
Material	a-Si:H	SiO_2	a-Si:H	$a\text{-}SiO_x:H_y$	SiO_2
Thickness	512.57	211.45	144.32	69.51	548.39

Example 2

[0065] A second side of a near-infrared narrowband filter provided by an example of the present disclosure may be coated with a set of wideband pass films or a set of longwave pass films. Table 2a is a table showing the layer thicknesses of the films in the set of wideband pass films or the set of longwave pass films, and this table reflects the layer structure of the set of wideband pass films or the set of longwave pass films of the near-infrared narrowband filter of the present disclosure. Two film materials are alternately coated with different thicknesses to form a required film set structure. In the structure shown in Table 2a, SiO_2 is a low refractive index dielectric material, and TiO_2 is a high refractive index material.

[0066] When a first side of the near-infrared narrowband filter is coated with a set of bright reflection color, narrowband pass films, a structure shown in Table 2b below may be referred to. Table 2b is a table showing the layer thicknesses of the films in the set of bright reflection color, narrowband pass films, and this table reflects the layer structure of the set of bright reflection color, narrowband pass films of the set of narrowband pass films of the near-infrared narrowband filter of the present disclosure. Also, two film materials are alternately coated with different thicknesses to form a corresponding film set structure, wherein a high refractive index silicon-based material is a-Si:H, and a low refractive index dielectric material is SiO_2. According to a 1931 CIE xyz system characterization, the double-sided coating filters prepared based on Table 2a and Table 2b are characterized as (0.351, 0.324, 53.03%) and (0.356, 0.315, 49.09%) when the incident light is incident at an angle of 0° and 30°, respectively, where x and y represent the chromaticity coordinates of the color, and z represents the brightness of the color. FIG. 4a is a diagram showing a relationship between reflectivity and wavelength of a filter coated with the set of bright reflection color, narrowband pass films provided in example 2 of the present disclosure.

[0067] When a first side of the near-infrared narrowband filter is coated with a set of dark reflection color, narrowband pass films, a structure shown in Table 2c below may be

referred to. Table 2c is a table showing the layer thickness of the films in the set of dark reflection color, narrowband pass films, and this table reflects the layer structure of the set of dark reflection color, narrowband films of the set of narrowband pass films of the near-infrared narrowband filter of the present disclosure. Also, two film materials are alternately coated with different thicknesses to form a corresponding film set structure, wherein a high refractive index silicon-based material is a-Si:H, and a low refractive index dielectric material is SiO_2. According to a 1931 CIE xyz system characterization, the double-sided coating filters prepared based on Table 2a and Table 2c are characterized as (0.301, 0.319, 35.22%) and (0.276, 0.309, 29.66%) when the incident light is incident at an angle of 0° and 30°, respectively, where *x* and *y* represent the chromaticity coordinates of the color, and *z* represents the brightness of the color. FIG. 4b is a diagram showing a relationship between reflectivity and wavelength of a filter coated with the set of dark reflection color, narrowband pass films provided in example 2 of the present disclosure.

Table 2a: Layer thickness of film in a set of wideband pass films or a set of longwave pass films, unit: nm

Layer number	1	2	3	4	5	6
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	TiO_2
Thickness	134.4	72.6	90.3	67.45	120.98	77.91
Layer number	7	8	9	10	11	12
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	TiO_2
Thickness	136	83.4	97.5	70.9	270.45	75.64
Layer number	13	14	15	16	17	18
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	TiO_2
Thickness	111.7	67.6	101.7	197.77	116.51	74.86
Layer number	19	20	21	22	23	24
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	TiO_2
Thickness	118.7	75.8	120.1	76. 6	103.28	42.14
Layer number	25	2	27	28	29	30
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	TiO_2
Thickness	133.6	83.1	131.4	83.54	133.68	85.88
Layer number	31	32	33	34	35	36
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	TiO_2
Thickness	133.1	84.1	135.3	84.91	135.75	84.61
Layer number	37	38	39	40	41	42
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	TiO_2
Thickness	87.1	75.6	124.5	80.29	129.71	82.58
Layer number	43	44	45	46	47	-
Material	SiO_2	TiO_2	SiO_2	TiO_2	SiO_2	-
Thickness	136.4	87.5	130.1	77.82	103.24	-

Table 2b: Layer thickness of film in a set of bright reflection color, narrowband pass films, unit: nm

Layer number	1	2	3	4	5
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-Si:H
Thickness	148.86	385.37	60.57	498.56	133.63
Layer number	6	7	8	9	10
Material	SiO_2	a-Si:H	SiO_2	a-Si:H	SiO_2
Thickness	148.47	58.19	146.02	389.75	168.05
Layer number	11	12	13	14	15
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-Si:H
Thickness	77.19	107.45	399.35	116.46	83.12
Layer number	16	17	18	19	20
Material	SiO_2	a-Si:H	SiO_2	a-Si:H	SiO_2
Thickness	125.35	404.06	54.76	98.94	130.29
Layer number	21	22	23	24	
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	
Thickness	501.89	230.75	100.12	459.47	

Table 2c: Layer thickness of film in a set of dark reflection color, narrowband pass films, unit: nm

Layer number	1	2	3	4	5
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-Si:H
Thickness	149.59	386.15	55.34	523.36	133.76
Layer number	6	7	8	9	10
Material	SiO_2	a-Si:H	SiO_2	a-Si:H	SiO_2
Thickness	114.26	71.4	170.76	395.02	104.98
Layer number	11	12	13	14	15
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	a-Si:H
Thickness	68.05	166.6	397.26	100.06	70.54
Layer number	16	17	18	19	20
Material	SiO_2	a-Si:H	SiO_2	a-Si:H	SiO_2
Thickness	148.01	413.09	47.19	73.44	170.98
Layer number	21	22	23	24	25
Material	a-Si:H	SiO_2	a-Si:H	SiO_2	-
Thickness	514.17	197.5	127.25	475.28	-

Example 3

[0068] A second side of a near-infrared narrowband filter provided by an example of the present disclosure may be coated with a set of wideband pass films or a set of longwave pass films. Table 3a is a table showing the layer thicknesses of the films in the set of wideband pass films or the set of longwave pass films, and this table reflects the layer structure of the set of wideband pass films or the set of longwave pass films of the near-infrared narrowband filter of the present disclosure. Two film materials are alternately coated with different thicknesses to form a required film set structure. In the structure shown in Table 3a, SiO_2 is a low refractive index dielectric material, and Si:H is a high

refractive index silicon-based material.

[0069] When a first side of the near-infrared narrowband filter is coated with a set of bright reflection color, narrowband pass films, a structure shown in Table 3b below may be referred to. Table 3b is a table showing the layer thicknesses of the films in the set of bright reflection color, narrowband pass films, and this table reflects the layer structure of the set of bright reflection color, narrowband pass films of the set of narrowband pass films of the near-infrared narrowband filter of the present disclosure. Also, two film materials are alternately coated with different thicknesses to form a corresponding film set structure, wherein a high refractive index silicon-based material is a-Si:H, and a low refractive index dielectric material is SiO_2. According to a 1931 CIE xyz system characterization, the double-sided coating filters prepared based on Table 3a and Table 3b are characterized as (0.366, 0.292, 49.80%) and (0.372, 0.288, 49.47%) when the incident light is incident at an angle of 0° and 30°, respectively, where *x* and *y* represent the chromaticity coordinates of the color, and *z* represents the brightness of the color. FIG. 5a is a diagram showing a relationship between reflectivity and wavelength of a filter coated with the set of bright reflection color, narrowband pass films provided in example 3 of the present disclosure.

[0070] When a first side of the near-infrared narrowband filter is coated with a set of dark reflection color, narrowband pass films, a structure shown in Table 3c below may be referred to. Table 3c is a table showing the layer thickness of the films in the set of dark reflection color, narrowband pass films, and this table reflects the layer structure of the set of dark reflection color, narrowband films of the set of narrowband pass films of the near-infrared narrowband filter of the present disclosure. Two kinds of film materials are coated with different thicknesses to form a corresponding film set structure, wherein the two film materials are Ge:H, a high refractive index germanium-based material, and SiO_2, a low refractive index dielectric material. According to a 1931 CIE xyz system characterization, the double-sided coating filters prepared based on Table 3a and Table 3c are characterized as (0.339, 0.226, 26.65%) and (0.361, 0.246, 28.07%) when the incident light is incident at an angle of 0° and 30°, respectively, where *x* and *y* represent the chromaticity coordinates of the color, and *z* represents the brightness of the color. FIG. 5b is a diagram showing a relationship between reflectivity and wavelength of a filter coated with the set of dark reflection color, narrowband pass films provided in example 3 of the present disclosure.

Table 3a: Layer thickness of film in a set of wideband pass films or a set of longwave

films, unit: nm

Layer number	1	2	3	4	5
Material	Ge:H	SiO_2	Ge:H	SiO_2	Ge:H
Thickness	94.5	66.27	146.33	112.37	84.16
Layer number	6	7	8	9	10
Material	SiO_2	Ge:H	SiO_2	Ge:H	SiO_2
Thickness	126.13	105.98	20.95	282.78	114.81
Layer number	11	12	13	14	15
Material	Ge:H	SiO_2	Ge:H	SiO_2	Ge:H
Thickness	79.45	137.63	404.19	53.8	226.65
Layer number	16	17	18	-	-
Material	SiO_2	Ge:H	SiO_2	-	-
Thickness	126.6	524.32	274.33	-	-

Example 4

[0071] A second side of a near-infrared narrowband filter provided by an example of the present disclosure may be coated with a set of wideband pass films or a set of longwave pass films. Table 4a is a table showing the layer thicknesses of the films in the set of wideband pass films or the set of longwave pass films, and this table reflects the layer structure of the set of wideband pass films or the set of longwave pass films of the near-infrared narrowband filter of the present disclosure. Two film materials are alternately coated with different thicknesses to form a required film set structure. In the structure shown in Table 4a, SiO_2 is a low refractive index material, and Si:H is a high refractive index material.

[0072] When a first side of the near-infrared narrowband filter is coated with a set of bright reflection color, narrowband pass films, a structure shown in Table 4b below may be referred to. Table 4b is a table showing the layer thicknesses of the films in the set of bright reflection color, narrowband pass films, and this table reflects the layer structure of the set of bright reflection color, narrowband pass films of the set of narrowband pass films of the near-infrared narrowband filter of the present disclosure. Also, two film materials are alternately coated with different thicknesses to form a corresponding film set structure, wherein a high refractive index silicon-based material is a-Si:H, and a low refractive index dielectric material is SiO_2. According to a 1931 CIE xyz system characterization, the double-sided coating filters prepared based on Table 4a and Table 4b are characterized as (0.366, 0.292, 49.80%) and (0.372, 0.288, 49.47%) when the incident light is incident at an angle of 0° and 30°, respectively, where x and y represent the chromaticity coordinates of the color, and z represents the brightness of the color. FIG. 6a is a diagram showing a relationship between reflectivity and wavelength of a filter coated

with the set of bright reflection color, narrowband pass films provided in example 4 of the present disclosure.

[0073] When a first side of the near-infrared narrowband filter is coated with a set of dark reflection color, narrowband pass films, a structure shown in Table 4c below may be referred to. Table 4c is a table showing the layer thickness of the films in the set of dark reflection color, narrowband pass films, and this table reflects the layer structure of the set of dark reflection color, narrowband films of the set of narrowband pass films of the near-infrared narrowband filter of the present disclosure. Two film materials are alternately coated with different thicknesses to form a corresponding film set structure, wherein the two film materials are Si_xGe_{1-x}:H, a high refractive index material, and SiO_2, a low refractive index dielectric material. According to a 1931 CIE xyz system characterization, the double-sided coating filters prepared based on Table 4a and Table 4c are characterized as (0.222, 0.179, 12.33%) and (0.232, 0.183, 11.97%) when the incident light is incident at an angle of 0° and 30°, respectively, where *x* and *y* represent the chromaticity coordinates of the color, and *z* represents the brightness of the color. FIG. 6b is a diagram showing a relationship between reflectivity and wavelength of a filter coated with the set of dark reflection color, narrowband pass films provided in example 4 of the present disclosure.

Table 4a: Layer thickness of film in a set of wideband pass films or a set of longwave pass films, unit: nm

Layer number	1	2	3	4	5	6
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	170.6	27.72	82.96	32.7	132.4	40.69
Layer number	6	7	8	9	10	11
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	101.55	31.19	119.83	37.6	122.7	34.77
Layer number	12	13	14	15	16	17
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	116.51	34.77	118.47	30.3	127.7	42.24
Layer number	18	19	20	21	22	23
Material	SiO_2	Si:H	SiO_2	Si:H	SiO_2	Si:H
Thickness	123.15	26.47	105.93	42.1	126.9	35.13
Layer number	24	25	26	-	-	-
Material	SiO_2	Si:H	SiO_2	-	-	-
Thickness	74.04	22.29	94.59	-	-	-

Table 4b: Layer thickness of film in a set of bright reflection color, narrowband pass films, unit: nm

Layer number	1	2	3	4	5

WHAT IS CLAIMED IS:

1. A near-infrared narrowband filter, characterized in that, the near-infrared narrowband filter comprises:

a substrate (11);

a set of narrowband pass films (12), disposed on a first side of the substrate (11); and

a set of wideband pass/longwave pass films (13), wherein the set of wideband pass/longwave pass films (13) is disposed on a second side of the substrate (11) opposite to the first side, and a passband of the set of wideband pass/longwave pass films (13) is wider than that of the set of narrowband pass films (12),

wherein the set of narrowband pass films (12) comprises a high refractive index layer (121) having a refractive index greater than 3 and a low refractive index layer (122) having a refractive index less than 3 within a wavelength range of 780 nm to 3000 nm, and

wherein a reflection color of the near-infrared narrowband filter in a CIE xyz coordinate system satisfies:

$x < 0.509$;

$y < 0.363$, and

$z < 50\%$.

2. The near-infrared narrowband filter according to claim 1, characterized in that the reflection color of the near-infrared narrowband filter in the CIE xyz coordinate system satisfies:

$x < 0.509$;

$y < 0.363$, and

$z < 30\%$.

3. The near-infrared narrowband filter according to claim 1 or 2, characterized in that the set of narrowband pass films (12) further comprises a middle refractive index layer, wherein:

a refractive index of the middle refractive index layer is between the refractive index of the high refractive index layer (121) and the refractive index of the low refractive index layer (122).

4. The near-infrared narrowband filter according to any one of claims 1 to 3, characterized in that the high refractive index layer (121) is formed by one or more of silicon hydride, Si_xGe_{1-x} and Si_xGe_{1-x}: H, or

the high refractive index layer (121) is formed by one or more of germanium hydride, Si_xGe_{1-x}, and Si_xGe_{1-x}: H.

5. The near-infrared narrowband filter according to any one of claims 1 to 4, characterized in that the low refractive index layer (122) is formed by one or more of SiO_2, Si_3N_4, SiO_xN_y, Ta_2O_5, Nb_2O_5, TiO_2, Al_2O_3, SiCN and SiC.

6. The near-infrared narrowband filter according to any one of claims 1 to 5, characterized in that, the near-infrared narrowband filter further comprises:

a plurality of middle refractive index layers having a refractive index ranging from 1.7 to 4.5 in the wavelength range of 780 nm to 3000 nm.

7. The near-infrared narrowband filter according to claim 3, characterized in that the middle refractive index layer is formed by one or more of a-SiO_x:H_y, a-SiN_x:H_y, a-GeO_x:H_y, a-GeN_x:H_y, a-$Si_zGe_{1-z}O_x$:H_y and a-$Si_zGe_{1-z}N_x$:H_y.

8. The near-infrared narrowband filter according to any one of claims 1 to 7, characterized in that a center wavelength shift of the passband of the set of narrowband pass films (12) is below 16 nm when an incident light enters the near-infrared narrowband filter at an angle of 0° to 30°.

9. The near-infrared narrowband filter according to any one of claims 1 to 8, characterized in that center wavelength drifts of *p* light and *s* light of the near-infrared narrowband filter are below 5 nm.

10. The near-infrared narrowband filter according to any one of claims 1 to 9, characterized in that a total thickness of the set of narrowband pass films (12) and the set of wideband pass/longwave pass films (13) is less than 15 μm.

11. A manufacturing method of a near-infrared narrowband filter, characterized in that, the manufacturing method comprises:

coating alternately a low refractive index layer (122) and a high refractive index layer (121) on a first side of a substrate (11) to form a set of narrowband pass films (12), and

coating a set of wideband pass/longwave pass films (13) on a second side of the substrate (11) opposite to the first side, wherein:

a passband of the set of wideband pass/longwave pass films (13) is wider than that of the set of narrowband pass films (12);

the set of narrowband pass films (12) comprises the high refractive index layer (121) having a refractive index greater than 3 and the low refractive index layer (122) having the refractive index less than 3 within a wavelength range of 780 nm to 3000 nm, and

a reflection color of the near-infrared narrowband filter in a CIE xyz coordinate system satisfies:

$x < 0.509$;

$y < 0.363$, and

$z < 50\%$.

12. The manufacturing method according to claim 11, characterized in that the manufacturing method is a coating method by sputtering coating or evaporation coating.

13. The manufacturing method according to claim 11 or 12, characterized in that forming the set of narrowband pass films (12) further comprises:

coating a middle refractive index layer, wherein a refractive index of the middle refractive index layer is between the refractive index of the high refractive index layer (121) and the refractive index of the low refractive index layer (122).

14. The manufacturing method according to claim 13, characterized in that, the manufacturing method further comprises:

bombarding a target with a charged ion beam obtained by glow discharge based on silicon, germanium, argon, hydrogen, and oxygen to coat the middle refractive index layer, wherein the middle refractive index layer comprises one or more of a-SiOx:Hy, a-SiNx:Hy, a-GeOx:Hy, a-GeNx:Hy, a-SizGe1-zOx:Hy and a-SizGe1-zNx:Hy.