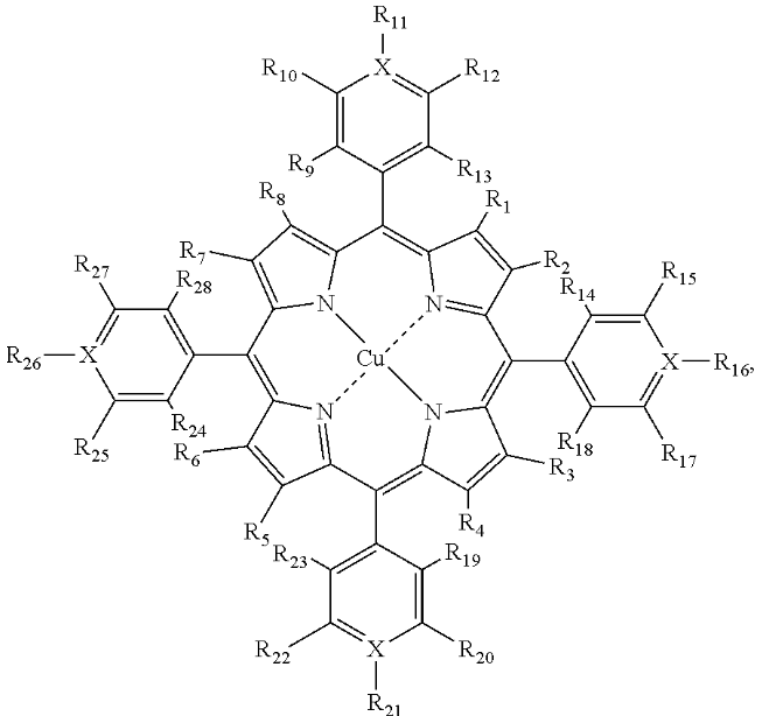
CLAIMS

1. A first system, comprising:

an optical filter comprising a Cu-porphyrin compound, wherein the Cu-porphyrin compound has a structure of:

(Formula I)



or a salt, or a tautomeric form thereof,

wherein:

X is carbon,

each of R_1 through R_8 is H; and

each of R_9 through R_{28} is independently H, F, Br, Cl, carboxylic acid, a carboxylic ester, or forms a 6-membered aromatic ring structure with an adjacent member of R_9 through R_{28};

wherein at least one of R_9-R_{13}, at least one of R_{14}-R_{18}, at least one of R_{19}-R_{23}, and at least one of R_{24}-R_{28} are not H and wherein at least two of R_9-R_{13}, at least two of R_{14}-R_{18}, at least two of R_{19}-R_{23}, and at least two of R_{24}-R_{28} are H; and

wherein the first system comprises a first substrate having a first surface and optionally a second substrate, and wherein the Cu-porphyrin compound is incorporated into the first system by one or more of:

(1) dispersing the Cu-porphyrin compound in a coating disposed on the first surface,

(2) dispersing the Cu-porphyrin compound through the first substrate, and

(3) dispersing the Cu-porphyrin compound in a polymer interlayer disposed between the first substrate and the second substrate, and

wherein

TS_{RG} is the average transmission of the first system across the wavelength range of 460-700 nm;

TS_{Blue} is the average transmission of the first system across the wavelength range of 400-460 nm;

TS_{RG}>=80%;

TS_{Blue}<TS_{RG}-5%.

2. The first system of claim 1, wherein
the Cu-porphyrin compound is Cu(II) meso-Tetra(1-naphthyl)porphine or Cu(II) meso-Tetra(4-carboxyphenyl)porphine.

3. The first system of claim 1, wherein each of R_9 through R_{28} is independently H, carboxylic acid, or a carboxylic ester.

4. The first system of claim 3, wherein each of R_9 through R_{28} is independently H or carboxylic acid.

5. The first system of claim 3, wherein each of R_9 through R_{28} is independently H or a carboxylic ester.

6. The first system claim 1, wherein on each phenyl ring to which R_9through R_{28} are attached, two adjacent members of R_9 through R_{28} form a 6-membered aromatic ring structure.

7. The first system of claim 1, wherein the first system is an ophthalmic system.

8. The first system of claim 7, wherein the first system is a contact lens.

9. The first system of claim 7, wherein the first system is an intra-ocular lens.

10. The first system of claim 1, wherein the first system is a non-ophthalmic ocular system.

11. The first system of claim 10, wherein the first system is an automotive windshield.

12. The first system of claim 10, wherein the first system is an automotive side window.

13. The first system of claim 10, wherein the first system is an automotive sunroof window.

14. The first system of claim 10, wherein the first system is commercial glass.

15. The first system of claim 10, wherein the first system is residential glass.

16. The first system of claim 1, wherein:

the optical filter has a transmission spectrum;

TF_{RG} is the average transmission of the optical filter across the wavelength range of 460-700 nm;

TF_{Blue} is the average transmission of the optical filter across the wavelength range of 400-460 nm;

TF_{RG}>=80%;

TF_{Blue}<TF_{RG}-5%; and

the optical filter has a first local minimum in transmission at a first wavelength within the wavelength range of 400-460 nm.

17. The first system of claim 1, wherein:

CIE Standard Illuminant D65 light having CIE LAB coordinates (a^*_1, b^*_1, L^*_1), when transmitted through the first system, results in transmitted light having CIE LAB coordinates (a^*_2, b^*_2, L^*_2), and

a total color difference ΔE between (a^*_1, b^*_1, L^*_1) and (a^*_2, b^*_2, L^*_2) is less than 5.0.

18. The first system of claim 1, wherein:

CIE Standard Illuminant D65 light having CIE LAB coordinates (a^*_1, b^*_1, L^*_1), when transmitted through the first system, results in transmitted light having CIE LAB coordinates (a^*_2, b^*_2, L^*_2), and

a total chroma difference between (a^*_1, b^*_1, L^*_1) and (a^*_2, b^*_2, L^*_2) is less than 5.0.

19. The first system of claim 1, wherein the first system has a yellowness index (YI) of no more than 35.

20. The first system of claim 1, wherein the optical filter has a yellowness index (VI) of no more than 35.

21. The first system of claim 1, wherein:

for at least one wavelength within 10 nm of the first wavelength on the negative side, the slope of the transmission spectrum of the first system has an absolute value that is less than the absolute value of the slope of the transmission spectrum at a third wavelength,

wherein the third wavelength is more than 10 nm from the first wavelength on the negative side.

22. The first system of claim 1, wherein the Cu-porphyrin compound is Cu(II) meso-Tetra(1-naphthyl)porphine.

23. The first system of claim 1, wherein the Cu-porphyrin compound is Cu(II) meso-Tetra(4-carboxyphenyl)porphine.

24. The first system of claim 1, wherein the optical filter is incorporated in a layer of polyvinyl butyral (PVB).

25. The first system of claim 1, wherein the first system is a spectacle lens, a contact lens, an intra-ocular lens, an automotive windshield, an automotive side window, an automotive sunroof window, commercial glass, or residential glass.

26. The first system of claim 1, wherein the Cu-porphyrin compound is incorporated into the first system by dispersing the Cu-porphyrin compound in a coating disposed on the first surface.

27. The first system of claim 1, wherein the Cu-porphyrin compound is incorporated into the first system by dispersing the Cu-porphyrin compound through the first substrate.

28. The first system of claim 1, wherein the Cu-porphyrin compound is incorporated into the first system by dispersing the Cu-porphyrin compound in a polymer interlayer disposed between the first substrate and the second substrate.

29. A method, comprising:

dissolving a Cu-porphyrin compound in a solvent to make a solution;

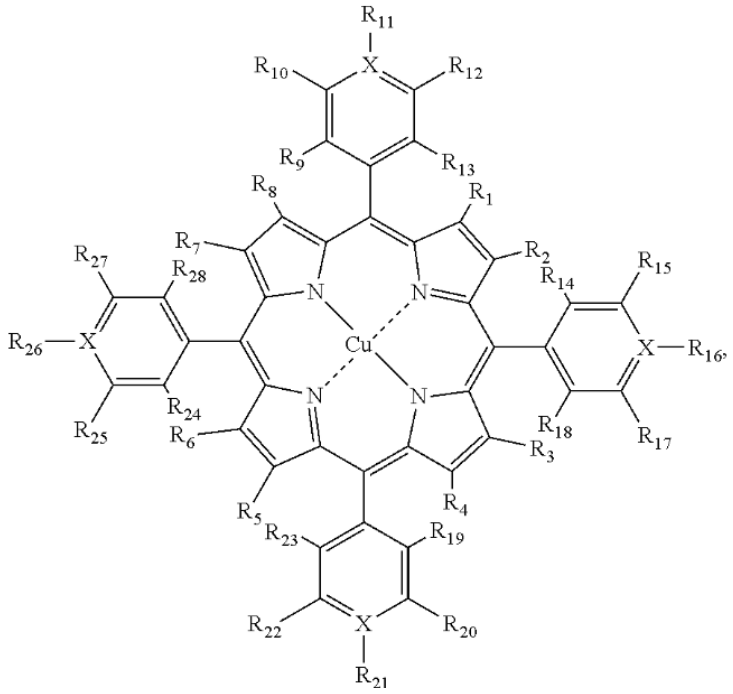
diluting the solution with a primer to obtain a diluted solution;

filtering the diluted solution to obtain a filtrate; and

applying the filtrate to form an optical filter,

wherein the Cu-porphyrin compound has a structure of:

(Formula I)



or a salt, or a tautomeric form thereof,

wherein:

X is carbon,

each of R_1 through R_8 is H; and

each of R_9 through R_{28} is independently H, F, Br, Cl, carboxylic acid, a carboxylic ester, or forms a 6-membered aromatic ring structure with an adjacent member of R_9 through;

where at least one of R_9-R_{13}, at least one of R_{14}-R_{18}, at least one of R_{19}-R_{23}, and at least one of R_{24}-R_{28} is not H and wherein at least two of R_9-R_{13}, at least two of R_{14}-R_{18}, at least two of R_{19}-R_{23}, and at least two of R_{24}-R_{28} are H;

wherein a first system comprises a first substrate having a first surface and optionally a second substrate, and wherein the Cu-porphyrin compound is incorporated into the first system by one or more of:

(1) dispersing the Cu-porphyrin compound in a coating disposed on the first surface,

(2) dispersing the Cu-porphyrin compound through the first substrate, and

(3) dispersing the Cu-porphyrin compound in a polymer interlayer disposed between the first substrate and the second substrate, and

wherein

TS_{RG} is the average transmission of the first system across the wavelength range of 460-700 nm;

TS_{Blue} is the average transmission of the first system across the wavelength range of 400-460 nm;

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