

DESCRIPTION

**ORGANIC SEMICONDUCTOR MATERIAL AND LIGHT-EMITTING
ELEMENT, LIGHT-EMITTING DEVICE, LIGHTING SYSTEM, AND
ELECTRONIC DEVICE USING THE SAME**

TECHNICAL FIELD

[0001]

The present invention relates to an organic semiconductor. The present invention also relates to a light-emitting element, a light-emitting device, a lighting system, and an electronic device in each of which any of the above materials is used.

BACKGROUND ART

[0002]

An organic compound can take various structures in comparison with an inorganic compound, and it is possible to synthesize a material having various functions by appropriate molecular design of an organic compound. Owing to those advantages, electronics utilizing a functional organic material has been attracting attention in recent years.

[0003]

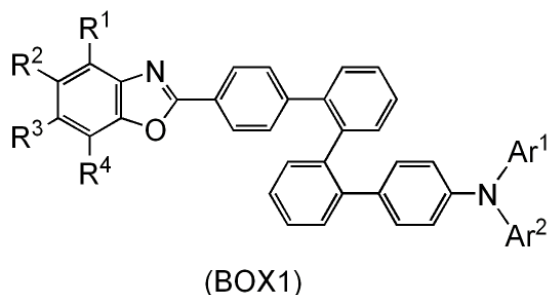
For example, a solar cell, a light-emitting element, an organic transistor, and the like are given as examples of an electronic device utilizing an organic compound as a functional material. Those are devices taking advantage of electric properties and optical properties of the organic compound. Among them, in particular, a light-emitting element has been remarkably developed.

[0004]

It is said that the light emission mechanism of a light-emitting element is as follows: by application of voltage between a pair of electrodes with a light-emitting layer interposed therebetween, electrons injected from a cathode and holes injected from an anode are recombined in the light-emitting layer to form molecular excitons and when the molecular excitons relax to a ground state, energy is released to emit light. Singlet excitation (S^*) and triplet excitation (T^*) are known as excited states. Light emission is considered possible through either singlet excitation or triplet excitation.

CLAIMS

1. An organic semiconductor material represented by General Formula (BOX1):

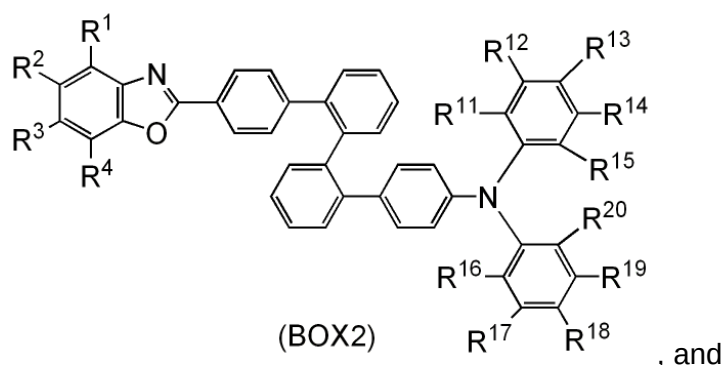


wherein:

Ar¹ and Ar² each independently represent a substituted or unsubstituted aryl group having 6 to 13 carbon atoms; and

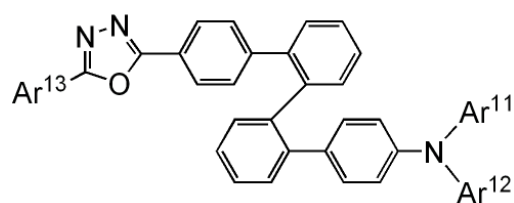
R¹ to R⁴ each independently represent any of hydrogen, an alkyl group having 1 to 4 carbon atoms, an unsubstituted aryl group having 6 to 10 carbon atoms, or halogen.

2. The organic semiconductor material according to claim 1, wherein the organic semiconductor material is represented by General Formula (BOX2):



wherein R¹¹ to R²⁰ each independently represent any of hydrogen, alkyl group having 1 to 4 carbon atoms, or a substituted or unsubstituted aryl group having 6 to 13 carbon atoms.

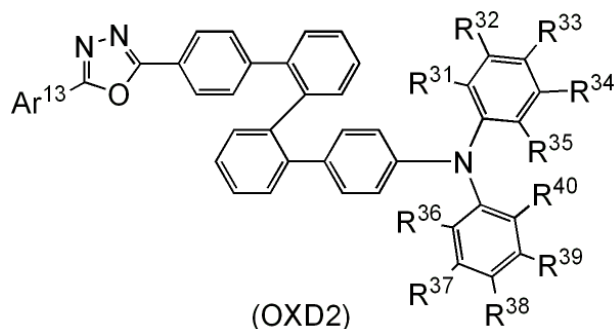
3. The organic semiconductor material according to claim 2, wherein R^1 to R^4 each are hydrogen.
4. The organic semiconductor material according to claim 2, wherein R^{11} to R^{20} each are hydrogen.
5. An organic semiconductor material represented by General Formula (OXD1):



(OXD1), and

wherein Ar^{11} , Ar^{12} , and Ar^{13} each represent a substituted or unsubstituted aryl group having 6 to 13 carbon atoms.

6. The organic semiconductor material according to claim 5, wherein the organic semiconductor material is represented by General Formula (OXD2):



(OXD2), and

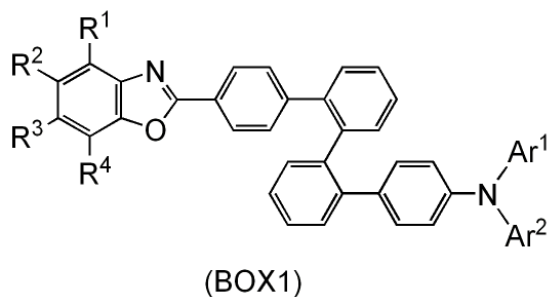
wherein R^{31} to R^{40} represent any of hydrogen, an alkyl group having 1 to 4 carbon atoms, or an unsubstituted aryl group having 6 to 13 carbon atoms.

7. The organic semiconductor material according to claim 6,
wherein Ar^{13} represents a substituted or unsubstituted phenyl group or a
substituted or unsubstituted naphthyl group.

8. The organic semiconductor material according to claim 6,
wherein Ar^{13} represents a substituted phenyl group, an unsubstituted 1-naphthyl
group, or an unsubstituted 2-naphthyl group.

9. The organic semiconductor material according to claim 6,
wherein R^{31} to R^{40} each are hydrogen.

10. A light-emitting element comprising:
a pair of electrodes; and
an organic semiconductor material represented by General Formula (BOX1):

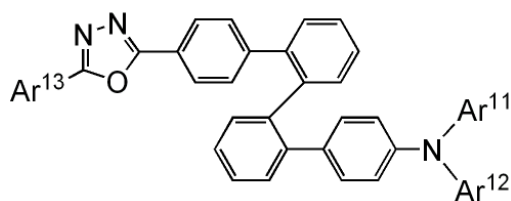


wherein:

Ar^1 and Ar^2 each independently represent a substituted or unsubstituted aryl
group having 6 to 13 carbon atoms; and

R^1 to R^4 each independently represent any of hydrogen, an alkyl group having 1
to 4 carbon atoms, an unsubstituted aryl group having 6 to 10 carbon atoms, or
halogen.

11. A light-emitting element comprising:
a pair of electrodes; and
an organic semiconductor material represented by General Formula (OXD1):



(OXD1)

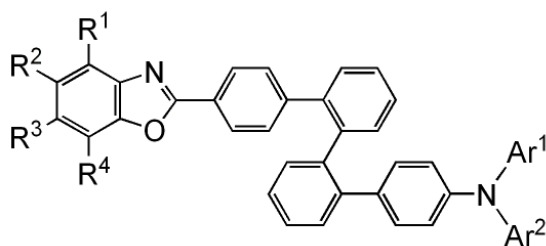
wherein Ar¹¹, Ar¹², and Ar¹³ each represents a substituted or unsubstituted aryl group having 6 to 13 carbon atoms.

12. An electric device having a display portion, the display portion comprising a light-emitting element,

wherein the light-emitting element comprises:

a pair of electrodes; and

an organic semiconductor material represented by General Formula (BOX1):



(BOX1)

, and

wherein:

Ar¹ and Ar² each independently represent a substituted or unsubstituted aryl group having 6 to 13 carbon atoms; and

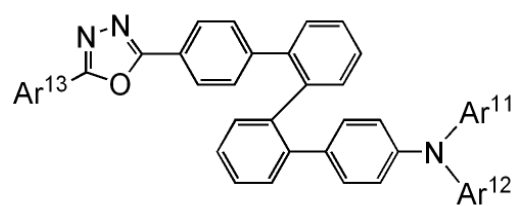
R¹ to R⁴ each independently represent any of hydrogen, an alkyl group having 1 to 4 carbon atoms, an unsubstituted aryl group having 6 to 10 carbon atoms, or halogen.

13. An electric device having a display portion, the display portion comprising a light-emitting element,

wherein the light-emitting element comprises:

a pair of electrodes; and

an organic semiconductor material represented by General Formula (OXD1):



(OXD1) , and

wherein Ar¹¹, Ar¹², and Ar¹³ each represents a substituted or unsubstituted aryl group having 6 to 13 carbon atoms.