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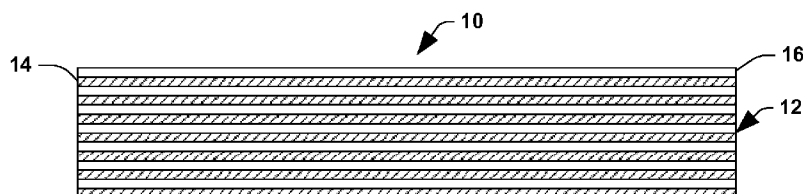


Fig. 1

(57) Abstract: An optical information storage medium includes a multilayer film that includes a plurality of extruded alternating active data storage layers and buffer layers, which separate the active data storage layers. The active data storage layers and buffer layers have thicknesses that allow the active data storage layers to be writable by permanent or reversible one- or multiphoton, linear, nonlinear, or threshold optical writing processes to define data voxels within the active data storage layers that are readable by an optical reading device.



AMENDED CLAIMS

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1. An optical information storage medium comprising a multilayer polymeric film that includes a plurality of coextruded alternating polymeric active data storage layers and polymeric buffer layers, which separate the active data storage layers, the active data storage layers and buffer layers having thicknesses that allow the active data storage layers to be writable by permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing processes to define data voxels within the active data storage layers that are readable by an optical reading device.

2. The medium of claim 1, the data voxels comprising at least one of discrete bits, images, shapes, and/or holograms.

3. The medium of claim 1, the ratio of thicknesses of the active storage layers to the thicknesses of the buffers layers reducing cross-talk, increasing signal-to-noise ratio, and reducing parasitic optical absorption and/or scattering.

4. The medium of claim 1, the active data storage layers including a material that undergoes an optically induced localized change of optical properties when written by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process.

5. The medium of claim 4, the change in optical properties including at least one of a change of linear, nonlinear absorption, fluorescence color, fluorescence intensity, absorption color, transparency, scattering, reflectivity, refractive index, phase, or polarization that is brought about by chemical or physical changes of the material.

6. The medium of claim 5, the material including a polymer and/or additives that exhibit the optically induced physical or chemical changes leading to changes of their optical properties.

7. The medium of claim 1, the active data storage layers including a host polymer material and a fluorescent dye, the fluorescent dye being reversible by exposure to

light between a first condition exhibiting a first fluorescence and a second condition exhibiting a second fluorescence different from the first fluorescence

8. The medium of claim 7, wherein the fluorescent dye is one of an excimer-forming, fluorescent dye or an aggregachromic dye.

9. The medium of claim 8, wherein the fluorescent dye is a photobleachable fluorescent dye.

10. The medium of claim 9, wherein the fluorescent dye is a cyano-substituted oligo(phenylene vinylene) dye.

11. The medium of claim 1, the active data storage layers including a host polymer material and a nanoparticle additive that undergoes an optically induced localized change of optical properties when written by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process.

12. The medium of claim 1, the active storage layers including a first thermoplastic polymer and the buffer layers including a second thermoplastic polymer, the first thermoplastic polymer and the second thermoplastic polymer having matching viscosities upon melting that allow the alternating data storage layers and the buffer layers to be coextruded and form the multilayer film.

13. The medium of claim 1, the multilayer film including at least 30 alternating layers.

14. The medium of claim 1, being at least one of a tape, card, disc, cylinder, microfiche, microfilm, flexible or non-flexible substrate, or information bearing document.

15. The medium of claim 1, being a three-dimensional optical memory.

16. An optical information storage medium comprising a multilayer polymeric film that includes a plurality of coextruded alternating polymeric active data storage layers and polymeric buffer layers, which separate the active data storage layers, the active data storage layers including a material that undergoes an optically induced localized change of optical properties when written by a permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process, thicknesses of the active data storage layers and buffer layers allowing the active data storage layers to be writable by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process to define data voxels within the active data storage layers that are readable by an optical reading device.

17. The medium of claim 16, the data voxels comprising at least one of discrete bits, images, shapes, and/or holograms.

18. The medium of claim 16, the ratio of thicknesses of the active storage layers to the thicknesses of the buffers layers reducing cross-talk, increasing signal-to-noise ratio, and reducing parasitic optical absorption and/or scattering.

19. The medium of claim 16, the change in optical properties including at least one of a change of linear, nonlinear absorption, fluorescence color, fluorescence intensity, absorption color, transparency, scattering, reflectivity, refractive index, phase, or polarization that is brought about by chemical or physical changes of the material.

20. The medium of claim 16, the material including a polymer and/or additives that exhibit the optically induced physical or chemical changes leading to changes of their optical properties.

21. The medium of claim 16, the active data storage layers including a host polymer material and a fluorescent dye, the fluorescent dye being reversible by exposure to light between a first condition exhibiting a first fluorescence and a second condition exhibiting a second fluorescence different from the first fluorescence

22. The medium of claim 21, wherein the fluorescent dye is one of an excimer-forming, fluorescent dye or an aggregachromic dye.
23. The medium of claim 16, wherein the fluorescent dye is a photobleachable fluorescent dye.
24. The medium of claim 23, wherein the fluorescent dye is a cyano-substituted oligo(phenylene vinylene) dye.
25. The medium of claim 16, the active storage layers including a first thermoplastic polymer and the buffer layers including a second thermoplastic polymer, the first thermoplastic polymer and the second thermoplastic polymer having matching viscosities upon melting that allow the alternating data storage layers and the buffer layers to be coextruded and form the multilayer film.
26. The medium of claim 16, the multilayer film including at least 30 alternating layers.
27. The medium of claim 16, the active data storage layers including a host polymer material and a nanoparticle additive that undergoes an optically induced localized change of optical properties when written by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process.
28. The medium of claim 16, being at least one of a tape, card, disc, cylinder, microfiche, microfilm, flexible or non-flexible substrate or information bearing document.
29. The medium of claim 16, being a three-dimensional optical memory.
30. An optical information storage medium comprising a multilayer polymeric film that includes a plurality of coextruded alternating thermoplastic active data storage layers and thermoplastic buffer layers, which separate the thermoplastic active data storage layers, the thermoplastic active data storage layers including a material that undergoes an

optically induced localized change of optical properties when written by a permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process, wherein thicknesses of the thermoplastic active data storage layers and thermoplastic buffer layers allowing the active data storage layers to be writable by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process to define data voxels within the thermoplastic active data storage layers that are readable by an optical reading device and wherein the thermoplastic active data storage layers and thermoplastic buffer layers have matching melt viscosities that allow the alternating data storage layers and the buffer layers to be coextruded and form the multilayer polymeric film.

31. The medium of claim 30, the data voxels comprising at least one of discrete bits, images, shapes, and/or holograms.

32. The medium of claim 31, the ratio of thicknesses of the active storage layers to the thicknesses of the buffers layers reducing cross-talk, increasing signal-to-noise ratio, and reducing parasitic optical absorption and/or scattering.

33. The medium of claim 30, the change in optical properties including at least one of a change of linear, nonlinear absorption, fluorescence color, fluorescence intensity, absorption color, transparency, scattering, reflectivity, refractive index, phase, or polarization that is brought about by chemical or physical changes of the material.

34. The medium of claim 30, the material including a polymer and/or additives that exhibit the optically induced physical or chemical changes leading to changes of their optical properties.

35. The medium of claim 30, the active data storage layers including a host polymer material and a fluorescent dye, the fluorescent dye being reversible by exposure to light between a first condition exhibiting a first fluorescence and a second condition exhibiting a second fluorescence different from the first fluorescence

36. The medium of claim 35, wherein the fluorescent dye is one of an excimer-forming, fluorescent dye or an aggregachromic dye.

37. The medium of claim 30, wherein the fluorescent dye is a photobleachable fluorescent dye.

38. The medium of claim 35, wherein the fluorescent dye is a cyano-substituted oligo(phenylene vinylene) dye.

39. The medium of claim 30, the multilayer film including at least 30 alternating layers.

40. The medium of claim 30, the active data storage layers including a host polymer material and a nanoparticle additive that undergoes an optically induced localized change of optical properties when written by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process.

41. The medium of claim 30, being at least one of a tape, card, disc, cylinder, microfiche, microfilm, flexible or non-flexible substrate, or information bearing document.

42. The medium of claim 30, being a three-dimensional optical memory.

43. A method of forming an optical information storage medium comprising:
coextruding a thermoplastic active data storage material and thermoplastic buffer material to form a multilayer polymeric film comprising alternating thermoplastic active data storage layers and thermoplastic buffer layers, wherein thermoplastic active data storage layers are separated by the thermoplastic buffer layers, the thermoplastic active data storage layers and thermoplastic buffer layers of the multilayer film having thicknesses that allow the active data storage layers to be writable by permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process to define data voxels within the active data storage layers that are readable by an optical reading device.

44. The method of claim 43, the data voxels comprising at least one of discrete bits, images, shapes, and/or holograms.

45. The method of claim 43, the ratio of thicknesses of the thermoplastic active storage layers to the thicknesses of the thermoplastic buffers layers reducing cross-talk, increasing signal-to-noise ratio, and reducing parasitic optical absorption and/or scattering.

46. The method of claim 43, the thermoplastic active data storage layers including an optical material that undergoes an optically induced localized change of optical properties when written by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process

47. The method of claim 46, the change in optical properties including at least one of a change of fluorescence color, fluorescence intensity, absorption color, transparency, scattering, reflectivity, phase, or polarization that is brought about by chemical or physical changes of the material.

48. The method of claim 47, the optical material including a polymer and/or additives that exhibit the optically induced physical or chemical changes leading to changes of their optical properties.

49. The method of claim 43, the thermoplastic active data storage layers including a host polymer material and a fluorescent dye, the fluorescent dye being reversible by exposure to light between a first condition exhibiting a first fluorescence and a second condition exhibiting a second fluorescence different from the first fluorescence

50. The method of claim 49, wherein the fluorescent dye is one of an excimer-forming, fluorescent dye or an aggregachromic dye.

51. The method of claim 50, wherein the fluorescent dye is a photobleachable fluorescent dye.

52. The method of claim 51, wherein the fluorescent dye is a cyano-substituted oligo(phenylene vinylene) dye.

53. The method of claim 43, the multilayer film including at least 30 alternating layers.

54. The method of claim 43, the active data storage layers including a host polymer material and a nanoparticle additive that undergoes an optically induced localized change of optical properties when written by the non-linear or threshold writing process.

55. An optical data storage system comprising:
a multilayer polymeric film that includes a plurality of coextruded alternating polymeric active data storage layers and polymeric buffer layers, which separate the active data storage layers, the active data storage layers and buffer layers having thicknesses that allow the active data storage layers to be writable by permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process to define data voxels within the active data storage layers that are readable by an optical reading device;
a permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing device for defining data voxels within the active data storage layers; and
an optical reading device for reading data voxels defined with the active data storage layers.

56. The system of claim 55, the data voxels comprising at least one of discrete bits, images, shapes, and/or holograms.

57. The system of claim 55, the ratio of thicknesses of the active storage layers to the thicknesses of the buffers layers reducing cross-talk, increasing signal-to-noise ratio, and reducing parasitic optical absorption and/or scattering.

58. The system of claim 55, the active data storage layers including a material that undergoes an optically induced localized change of optical properties when written by the

permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process.

59. The system of claim 58, the change in optical properties including at least one of a change of fluorescence color, fluorescence intensity, absorption color, transparency, scattering, reflectivity, phase, or polarization that is brought about by chemical or physical changes of the material.

60. The system of claim 55, the active data storage layers including a polymer and/or additives, any of which are responsible for the optically induced physical or chemical changes leading to changes of their optical properties.

61. The system of claim 60, the active data storage layers including a host polymer material and a fluorescent dye, the fluorescent dye being reversible by exposure to light between a first condition exhibiting a first fluorescence and a second condition exhibiting a second fluorescence different from the first fluorescence

62. The system of claim 61, wherein the fluorescent dye is one of an excimer-forming, fluorescent dye or an aggregachromic dye.

63. The system of claim 61, wherein the fluorescent dye is a photobleachable fluorescent dye.

64. The system of claim 61, wherein the fluorescent dye is a cyano-substituted oligo(phenylene vinylene) dye.

65. The system of claim 55, the active data storage layers including a host polymer material and a nanoparticle additive that undergoes an optically induced localized change of optical properties when written by the permanent or reversible one-or multiphoton, linear, nonlinear, or threshold optical writing process.

66. The system of claim 55, the active storage layers including a first thermoplastic polymer and the buffer layers including a second thermoplastic polymer, the first thermoplastic polymer and the second thermoplastic polymer having viscosities upon melting that allow the alternating data storage layers and the buffer layers to be coextruded and form the multilayer film.

67. The system of claim 55, the multilayer film including at least 30 alternating layers.

68. The system of claim 55, the multilayer film being flexible.

69. The system of claim 55, the optical information storage medium being at least one of a tape, card, disc, cylinder, microfiche, microfilm, or information bearing document.