CLAIMS

1. A composite photonic structure, comprising:

one or more parallel layers of a structural material;

a diffractive grating in registry with the one or more layers of structural material, the grating including a plurality of features that are arranged to have periodicity in at least one dimension; and

a fluorophore material embedded within the composite photonic structure.

2. A structure according to Claim 1, in which the grating is one or more of:

a discrete layer of one or more grating materials disposed over an entire surface of the one or more layers of structural material, and

defined by a surface of the one or more layers of structural material, and in which the structural material is a non-metallic material.

3. A structure according to Claim 2, in which the grating extends over one or more of a top surface and a bottom surface of at least one of the one or more layers of structural material.

4. A structure according to Claim 1, in which the grating layer is in registry with a first layer of the one or more layers of structural material, in which the fluorophore material is embedded within a second layer of the one or more layers of the structural material, and in which the fluorophore material and the diffractive grating are separated by an intervening layer such that the diffractive grating and fluorophore material are spaced apart.

5. A structure according to Claim 1, in which the plurality of features of the grating are arranged to have periodicity in at least two dimensions.

6. A structure according to Claim 1, in which the fluorophore is of the type that is excited by radiation having a first wavelength and emits radiation having a second wavelength upon excitation, and in which the one or more layers of structural material and the grating are at least partially transparent to radiation having the first and second wavelengths.

7. A structure according to Claim 6, in which the fluorophore is incorporated into the structure as one of: a separate layer of material that includes at least the fluorophore material,

and a dopant or nano-material that is embedded in a region within at least one of the one or more layers of structural material.

8. A structure according to Claim 7, in which the fluorophore material is arranged within the composite structure to have consistent periodicity in at least one dimension.

9. A structure according to Claim 7, in which the fluorophore material extends throughout a cross-sectional area of the composite structure.

10. A structure according to Claim 6, further comprising;

a first set of elongate rods including the fluorophore material embedded within the one or more structural material layers, in which the rods in the first set are oriented parallel to one another and are spaced apart to have consistent periodicity in at least one dimension.

11. A structure according to Claim 10, further comprising;

a second set of elongate rods including the fluorophore material embedded within the one or more structural material layers, in which the rods in the second set are oriented parallel to one another and are spaced apart to have consistent periodicity in at least one dimension, and in which the second set of rods are oriented perpendicular to the first set of rods.

12. A structure according to Claim 4, in which the second layer including the fluorophore material and the diffractive grating are separated by an intervening layer of the structural material such that the diffractive grating and fluorophore material are spaced apart.

13. A structure according to Claim 6, in which the fluorophore layer is arranged between the one or more layers of structural material thereby separating two layers of structural material.

14. A structure according to Claim 6, in which the fluorophore material is embedded within the structural material as one or more of: a dopant and a nano-material.

15. A structure according to Claim 1, in which the grating features have periodicity as defined by a first value, and in which the first value is defined as function of a size of perturbations to be detected during use of the composite structure.