CLAIMS

What is claimed is:

1. A carbon dioxide (CO_2) sensitive dielectric nanocomposite comprising:

a low molecular weight organic containing a CO_2 sensitive functional group, wherein the low molecular weight organic has a molecular weight less than five hundred grams per mole (<500 g/mol);

a resin; and

P-type carbon nanotubes (CNTs), wherein a concentration of the P-type carbon nanotubes in the CO_2 sensitive dielectric nanocomposite is less than 1 wt%.

2. The CO_2 sensitive dielectric nanocomposite in accordance with Claim 1 wherein the low molecular weight organic comprises amidine as the CO_2 sensitive functional group.

3. The CO_2 sensitive dielectric nanocomposite in accordance with Claim 2 wherein the CO_2 sensitive functional group comprises 1,5,7-Triazabicyclo[4.4.0]dec-5-ene.

4. The CO_2 sensitive dielectric nanocomposite in accordance with Claim 1 wherein the low molecular weight organic comprises diamine as the CO_2 sensitive functional group.

5. The CO_2 sensitive dielectric nanocomposite in accordance with Claim 4 wherein the CO_2 sensitive functional group comprises (1R,2R)-(+)-1,2-diphenylethylenediamine.

6. The CO_2 sensitive dielectric nanocomposite in accordance with Claim 1 wherein the resin comprises an ultraviolet (UV) curable urethane acrylate resin.

7. The CO_2 sensitive dielectric nanocomposite in accordance with Claim ~~8~~ 1 wherein a concentration of the P-type carbon nanotubes in the CO_2 sensitive dielectric nanocomposite is 0.5 wt%.

8. The CO_2 sensitive dielectric nanocomposite in accordance with Claim 1 wherein the CO_2 sensitive dielectric nanocomposite is formed as a solid film CO_2 sensitive dielectric material.

9. A capacitive carbon dioxide (CO_2) sensor comprising:

a substrate;

a plurality of capacitive electrodes patterned onto the substrate; and

a CO_2 sensitive dielectric nanocomposite film on the plurality of capacitive electrodes for altering a capacitance between a pair of the capacitive electrodes in response to CO_2, wherein the CO_2 sensitive dielectric nanocomposite film comprises:

a low molecular weight organic containing a CO_2 sensitive functional group, wherein the low molecular weight organic has a molecular weight less than five hundred grams per mole (500 g/mol);

a resin; and

P-type carbon nanotubes (CNTs), wherein a concentration of the P-type carbon nanotubes in the CO_2 sensitive dielectric nanocomposite is less than 1 wt%.

10. The CO_2 sensor in accordance with Claim 9 wherein the pair of the plurality of capacitive electrodes comprises a pair of laterally separated capacitive electrodes.

11. The CO_2 sensor in accordance with Claim 10 wherein the pair of laterally separated capacitive electrodes comprises a pair of laterally separated meandering electrodes.

12. The CO_2 sensor in accordance with Claim 10 wherein the pair of laterally separated capacitive electrodes comprises a pair of laterally separated interdigitated electrodes.

13. The CO_2 sensor in accordance with Claim 9 wherein the CO_2 sensitive dielectric nanocomposite film comprises a CO_2 sensitive dielectric nanocomposite film with a thickness of two to twenty-five micrometers.

14. A method for fabrication of a capacitive carbon dioxide (CO_2) sensor comprising:

forming a CO_2 sensitive dielectric nanocomposite comprising:

dissolving a low molecular weight organic containing a CO_2 sensitive functional group in an organic solvent to form a first solution, wherein the low molecular weight organic has a molecular weight less than five hundred grams per mole (500 g/mol);

dispersing P-type carbon nanotubes in an organic solvent to form a second solution;

mixing the first solution and the second solution to form a nanocomposite solution; and

adding a resin to the nanocomposite solution;

depositing the nanocomposite solution with the resin as a nanocomposite film on a surface of a substrate with capacitive electrodes, wherein a concentration of the P-type carbon nanotubes in the nanocomposite film is less than 1 wt%; and

curing the nanocomposite film on the capacitive electrodes to form the capacitive CO_2 sensor.

15. The method in accordance with Claim 14 wherein the organic solvent is tetrahydrofuran (THF).

16. The method in accordance with Claim 14 wherein the step of dissolving the CO_2 sensitive functional group in the organic solvent comprises dissolving a diamine in the organic solvent

17. The method in accordance with Claim 16 wherein the step of dissolving diamine in the organic solvent comprises dissolving (1R,2R)-(+)-1.2-diphenylethylenediamine in the organic solvent.

18. The method in accordance with Claim 14 wherein the step of dissolving the low molecular weight organic containing the CO_2 sensitive functional group in the organic solvent comprises dissolving an amidine in the organic solvent.

19. The method in accordance with Claim 18 wherein the step of dissolving the amidine in the organic solvent comprises dissolving 1,5,7-Triazabucyclo[4.4.0]dec-5-ene in the organic solvent.

20. The method in accordance with Claim 14 wherein forming the CO_2 sensitive dielectric nanocomposite further comprises adding an ultraviolet (UV) cross-linker to the first solution before mixing the first solution and the second solution to form the nanocomposite solution, and wherein the step of curing the nanocomposite film comprises curing the nanocomposite film on the capacitive electrodes by UV radiation to form the capacitive CO_2 sensor.

21. The method in accordance with Claim 14 wherein the step of depositing the nanocomposite film on the surface of the capacitive electrodes comprises depositing the nanocomposite solution with the resin as a nanocomposite film with a thickness of two to twenty-five micrometers on the surface of the capacitive electrodes by an aerosol spray method.