Claims

What is claimed is:

1. An energetic formulation, comprising graphene oxide functionalized with a molecule containing at least one epoxy group, wherein the functionalized graphene oxide has an oxygen content between 30% to 50% (Atomic) and decomposes at a temperature between 200º and 250ºC.

2. The energetic formulation of claim 1, wherein the graphene oxide is further functionalized through oxidation with a nitro-group, an amino-group, or an oxoacid at a different location than a location of functionalization with the epoxy group.

3. The energetic formulation of claim 1, wherein the graphene oxide comprises at least one functional group containing nitrogen between a graphene sheet and the at least one epoxy group.

4. The energetic formulation of claim 1, wherein the epoxide is sourced from an epoxy silane, and the graphene oxide comprises at least one functional group containing nitrogen between a graphene sheet and the at least one epoxy group.

5. The energetic formulation of claim 1, wherein the epoxide is sourced from a hydrocarbon compound containing a plurality of epoxy groups.

6. The energetic formulation of claim 1, wherein the functionalized graphene oxide is coated onto ammonium perchlorate.

7. The energetic formulation of claim 1, wherein the functionalized graphene oxide is used as a stand-alone energetic material in powder form, mixed as powder in a liquid fuel, or mixed as a powder in a solid fuel.

8. The energetic formulation of claim 7, wherein the liquid fuel or solid fuel in which the functionalized graphene oxide is mixed is metal-free.

9. A method of preparing an energetic formulation, comprising functionalizing graphene oxide with a molecule containing at least one epoxy group.

10. The method of claim 9, comprising further functionalizing the graphene oxide through oxidation of the graphene oxide with a nitro group, an amino group, or an oxoacid, at a different location than a location of functionalization with the epoxy group.

11. The method of claim 9, wherein the functionalizing step comprises modifying an epoxy-containing molecule with at least one functional group containing nitrogen, and functionalizing a graphene sheet with the modified epoxy-containing molecule, such that

the at least one functional group containing nitrogen is between the graphene sheet and the at least one epoxy group.

12. The method of claim 9, wherein the epoxide is sourced from an epoxy silane, and functionalizing step comprises functionalizing at least one functional group containing silicon between a graphene sheet and the at least one epoxy group.

13. The method of claim 9, wherein the epoxy group is sourced from a hydrocarbon compound containing a plurality of epoxy groups.

14. The method of claim 9, further comprising coating ammonium perchlorate with the functionalized graphene oxide.

15. The method of claim 9, further comprising using the functionalized graphene oxide as a stand-alone energetic material in powder form, mixing the functionalized graphene oxide within a liquid fuel, or mixing the functionalized graphene oxide as a powder in a solid fuel.

16. The method of claim 15, wherein the liquid fuel or solid fuel in which the functionalized graphene oxide is mixed is metal-free.

17. The method of claim 9, wherein the functionalizing step is performed when the graphene oxide is suspended in water at a concentration of 0.5% to 10%.

18. The method of claim 9, wherein the functionalizing step further comprises condensing an epoxy-containing hydrocarbon compound with the graphene oxide using stannous chloride ($SnCl_2$) as a catalyst.

19. The method of claim 18, wherein the functionalizing step is performed within an acetone solvent at approximately room temperature.

20. The method of claim 18, wherein the epoxy group is sourced from a hydrocarbon compound containing two or more epoxy groups, and the functionalizing step comprises bonding a first oxygen from a hydroxyl group, attached to a sheet of graphene oxide, to a carbon of a first epoxy group of the hydrocarbon, and thereby converting the first oxygen into an ether and the first epoxy group into a hydroxyl group.