What is claimed is:

1. A rubber composite structure having an unbound, reptated internal morphology, wherein a portion of rigid sulfidic linkages therein are each tethered at an original allylic carbocation and unbound at an original methyl carbocation.

2. A vulcanized rubber, wherein a portion of the rigid sulfidic linkages therein are each tethered at an original allylic carbocation and unbound at an original methyl carbocation, and wherein a portion of polymer backbones within the vulcanized rubber are substituted by an acetate moiety.

3. The rubber composite structure of claim 1, in a form of an an interlinked substituted rubber product selected from the group consisting of a tire tread, tire sidewall, roofing membrane, high dielectric electrical tape, tank lining, reservoir lining, trench lining, bridge underlayment, wire harness wrap, self-bonding wire harness wrap, shoe sole, rubber boot, electrical tape, foundation waterproofing, parking garage waterproofing material, hose, belt, and molding.

4. The rubber composite structure of claim 1, in a form of a rubber tire, wherein the rubber tire comprises from 3% by weight to 15% by weight of the rubber composite structure.

5. The rubber composite structure of claim 1, in a form of a rubber tire, wherein the rubber tire comprises from 15% by weight to 100% by weight of the rubber composite structure.

6. The rubber composite structure of claim 1, in a form of a tire tread, wherein the tire tread comprises from 10% by weight to 50% by weight of the rubber composite structure.

7. The rubber composite structure of claim 1, in a form of a tire sidewall, wherein the tire sidewall comprises from 5% by weight to 100% by weight of the rubber composite structure.

8. The rubber composite structure of claim 1, in a form of an asphalt-rubber binder, wherein the asphalt-rubber binder comprises from 5% by weight to 95% by weight of the rubber composite structure.

9. The rubber composite structure of claim 1, in a form of an asphalt emulsion, wherein the asphalt emulsion comprises from 5% by weight to 95% by weight of the rubber composite structure.

10. The rubber composite structure of claim 1, in a form of an asphalt roofing material, wherein the asphalt roofing material comprises from 5% by weight to 95% by weight of the rubber composite structure.

11. The rubber composite structure of claim 1, wherein a portion of polymer backbones within the rubber composite structure are substituted by an acetate moiety.

12. The rubber composite structure of claim 1, wherein the rubber composite structure is derived from an end-of-life tire.

13. The rubber composite structure of claim 1, further comprising copper and acetate moieties present at from 0.1 to 5.0 parts per hundred parts rubber (by weight).

14. The rubber composite structure of claim 1, further comprising a metal derived from a metal salt that undergoes a phase change from solid to liquid in a range of 115-150.degree. C.

15. The vulcanized rubber of claim 2, further comprising copper and acetate moieties present at from 0.1 to 5.0 parts per hundred parts rubber (by weight).

16. The vulcanized rubber of claim 2, further comprising a metal derived from a metal salt that undergoes a phase change from solid to liquid in a range of 115-150.degree. C.

17. The vulcanized rubber of claim 2, in a form of an an interlinked substituted rubber product selected from the group consisting of a tire tread, tire sidewall, roofing membrane, high dielectric electrical tape, tank lining, reservoir lining, trench lining, bridge underlayment, wire harness wrap, self-bonding wire harness wrap, shoe sole, rubber boot, electrical tape, foundation waterproofing, parking garage waterproofing material, hose, belt, and molding.

18. The vulcanized rubber of claim 2, in a form of a rubber tire, wherein the rubber tire comprises from 3% by weight to 15% by weight of the vulcanized rubber.

19. The vulcanized rubber of claim 2, in a form of a rubber tire, wherein the rubber tire comprises from 15% by weight to 100% by weight of the vulcanized rubber.

20. The vulcanized rubber of claim 2, in a form of a tire tread, wherein the tire tread comprises from 10% by weight to 50% by weight of the vulcanized rubber.

21. The vulcanized rubber of claim 2, in a form of a tire sidewall, wherein the tire sidewall comprises from 5% by weight to 100% by weight of the vulcanized rubber.

22. The vulcanized rubber of claim 2, in a form of an asphalt-rubber binder, wherein the asphalt-rubber binder comprises from 5% by weight to 95% by weight of the vulcanized rubber.

23. The vulcanized rubber of claim 2, in a form of an asphalt emulsion, wherein the asphalt emulsion comprises from 5% by weight to 95% by weight of the vulcanized rubber.

24. The vulcanized rubber of claim 2, in a form of an asphalt roofing material, wherein the asphalt roofing material comprises from 5% by weight to 95% by weight of the vulcanized rubber.

25. The vulcanized rubber of claim 2, wherein the vulcanized rubber is derived from an end-of-life tire.