

CLAIMS

What is claimed is:

1. A tire composition comprising:
 - (I) a polymer;
 - (II) a nanocellulose dispersion composition (NDC) comprising:
 - (i) a partitioning agent comprising a carbon black filler, an elastomer latex, a wax, or any combination thereof; and
 - (ii) a nanocellulose; and
 - (III) a carbon black additive;wherein the tire composition is characterized by a dispersion index, determined by interferometric microscopy (IFM), of at least about 90%.
2. A tire composition comprising:
 - (I) a polymer;
 - (II) a nanocellulose dispersion composition (NDC) comprising:
 - (i) a partitioning agent comprising a carbon black filler, an elastomer latex, a wax, or any combination thereof; and
 - (ii) a nanocellulose; and
 - (III) a carbon black additive;wherein the tire composition is characterized by a fatigue life at 100% tensile strain of at least about 300,000 cycles.
3. The tire composition of claim 1 or 2, wherein a weight ratio of the polymer to the nanocellulose dispersion composition (polymer:NDC) is in a range from about 100:1 to about 1:1, from about 80:1 to about 10:1, from about 75:1 to about 2:1, from about 60:1 to about 5:1, from about 50:1 to about 1:1, from about 40:1 to about 4:1, from about 75:1 to about 25:1, from about 90:1 to about 15:1, from about 75:1 to about 1.5:1, or from about 50:1 to about 2:1.
4. The tire composition of any one of claims 1-3, wherein the polymer comprises an elastomer.

5. The tire composition of any one of claims 1-4, wherein the nanocellulose dispersion composition has greater nanocellulose dispersibility in the polymer composition than that of the nanocellulose without the partitioning agent.
6. The tire composition of any one of claims 1-5, wherein the nanocellulose comprises nanocellulose crystals (NC), nanocellulose fibrils (NF), or a combination thereof.
7. The tire composition of any one of claims 1-6, wherein the nanocellulose comprises lignin-coated nanocellulose crystals (LCNC), lignin-coated nanocellulose fibrils (LCNF), or a combination thereof.
8. The tire composition of any one of claims 1-7, wherein the nanocellulose comprises hydrophilic cellulose nanocellulose crystals (CNC), hydrophilic cellulose nanocellulose fibrils (CNF), or a combination thereof.
9. The tire composition of any one of claims 1-8, wherein the nanocellulose dispersion composition (NDC) further comprises a hydrocarbon oil.
10. The tire composition of any one of claims 1-9, wherein the polymer comprises a natural rubber (NR), an isoprene rubber (IR), a polybutadiene rubber (BR), an emulsion styrene-butadiene rubber (ESBR), or any combination thereof.
11. The tire composition of any one of claims 1-10, wherein the wax comprises a non-branched alkane paraffin wax; a natural mineral, petroleum refined, or lignin refined branched paraffin wax or ceresine wax; a polyethylene wax; a functionalized polyethylene wax; or any combination thereof.
12. The tire composition of any one of claims 1-11, wherein the carbon black filler and the carbon black additive independently comprise a furnace carbon black and/or a surface-modified furnace carbon black.

13. The tire composition of any one of claims 1-12, wherein the carbon black filler and the carbon black additive are independently characterized by:

- a nitrogen surface area of from about 90 m²/g to about 140 m²/g;
- an external surface area of from about 80 m²/g to about 125 m²/g;
- a pH of from about 2.5 to about 9;
- a 50 GM void volume of from about 55 cm³/100g to about 67 cm³/100g;
- a 75 GM void volume of from about 50 cm³/100g to about 60 cm³/100g;
- a 100 GM void volume of from about 45 cm³/100g to about 55 cm³/100g;
- a moisture content of from about 2.5 wt. % to about 4.5 wt. %;
- a volatile content of from about 4.5 wt. % to about 6.5 wt. %;
- an oxygen content of from about 2.5 wt. % to about 5.5 wt. %; or
- any combination thereof.

14. The tire composition of any one of claims 1-13, wherein the partitioning agent comprises at least two of the carbon black filler, the elastomer latex, and the wax.

15. The tire composition of any one of claims 1-14, wherein a weight ratio of the partitioning agent to the nanocellulose is in a range from about 0.1:1 to about 25:1, from about 0.1:1 to about 10:1, from about 0.1:1 to about 5:1, from about 0.1:1 to about 1:1, from about 0.25:1 to about 15:1, from about 0.3:1 to about 10:1, from about 0.5:1 to about 25:1, from about 0.75:1 to about 15:1, or from about 1:1 to about 10:1.

16. The tire composition of any one of claims 1-15, wherein the nanocellulose dispersion composition (NDC) is produced by process comprising:

- (a) combining an aqueous dispersion of the nanocellulose with the partitioning agent to form a mixture; and
- (b) drying the mixture to form the nanocellulose dispersion composition (NDC).

17. The tire composition of any one of claims 1-15, wherein the nanocellulose dispersion composition (NDC) is produced by process comprising:

- (A) combining an aqueous dispersion of the nanocellulose with the partitioning agent to form a mixture; and
- (B) drying the mixture to form the nanocellulose dispersion composition (NDC);

wherein the partitioning agent is stable in the NDC and is spaced between nanocellulose particles to reduce or prevent agglomeration of the nanocellulose particles in the NDC.

18. The tire composition of any one of claims 1-17, wherein the tire composition contains:

from about 20 to about 150 phr of carbon black, from about 1 to about 15 phr of nanocellulose, and from about 1 to about 15 phr of hydrocarbon oil; or

from about 30 to about 100 phr of carbon black, from about 2 to about 10 phr of nanocellulose, and from about 2 to about 10 phr of hydrocarbon oil; or

from about 40 to about 80 phr of carbon black, from about 2 to about 7.5 phr of nanocellulose, and from about 3 to about 9 phr of hydrocarbon oil.

19. The tire composition of any one of claims 1-18, wherein the tire composition is characterized by a dispersion index, determined by interferometric microscopy (IFM), of at least about 92%, at least about 93%, at least about 94%, at least about 95%, at least about 96%, at least about 97%, or at least about 98%.

20. The tire composition of any one of claims 1-19, wherein the tire composition is characterized by an area fraction of undispersed material, determined by interferometric microscopy (IFM), of less than or equal to about 8%, less than or equal to about 6%, less than or equal to about 4%, less than or equal to about 3%, or less than or equal to about 2%.

21. The tire composition of any one of claims 1-20, wherein the tire composition is characterized by a fatigue life at 100% tensile strain of at least about 325,000 cycles, at least about 350,000 cycles, at least about 375,000 cycles, or at least about 400,000 cycles.

22. An article of manufacture comprising the tire composition of any one of claims 1-21.

23. The article of claim 22, wherein the article is a pneumatic tire, a passenger car tire, or a truck and bus radial tire.

24. The article of claim 22, wherein the article is a tire tread.