CLAIMS:

1. A process of making a graphene material-metal nanocomposite comprising:

forming a layer of graphene material and/or graphene-precursor material on at least a portion of a surface of or all of the surfaces of metal nanowires comprising forming a dispersion of a metal powder or a metal precursor and a graphene material and/or graphene-precursor material, wherein the metal powder is a nanopowder; and

calcining the metal nanowires comprising a layer of graphene-precursor material,

wherein the graphene material-metal nanocomposite is formed.

2. The process of claim 1, wherein the forming a layer of graphene material and/or graphene- precursor material on at least a portion of a surface of or all of the surfaces of metal nanowires comprises:

forming a dispersion of metal nanowires and the graphene material and/or graphene-precursor material.

3. The process of claim 2, wherein the forming a dispersion of metal nanowires and the graphene material and/or graphene-precursor material comprises:

dispersing metal nanowires in a dispersant; and

dispersing graphene material or graphene-precursor material in a dispersant, and adding the metal nanowire dispersion to the graphene material or graphene-precursor material dispersion.

4. The process of claim 2, wherein the metal nanowires are present at 95 to 99 wt.% (based on the total weight of metal nanowires and graphene material and/or graphene-precursor material) in the dispersion.

5. The process of claim 2, wherein the graphene material or graphene-precursor material is present 1 to 5 wt.% (based on the total weight of metal nanowires and graphene material and/or graphene-precursor material) in the dispersion.

6. The process of claim 2, wherein the dispersant of the dispersion is water, a C1 to C6 alcohol, or a combination thereof.

7. The process of claim 2, wherein the ratio of the metal nanowire weight to the graphene material and/or graphene-precursor material weight is 95:5 to 99: 1.

8. The process of claim 2, wherein the metal nanowires are chosen from copper nanowires, aluminum nanowires, copper alloy wires, and combinations thereof.

9. The process of claim 1, wherein the forming the dispersion comprises:

dispersing the metal powder or the metal precursor in a dispersant, and

dispersing the graphene material and/or graphene-precursor material in a dispersant

10. The process of claim 1, wherein the dispersion further comprises one or more water-soluble primary amine.

11. The process of claim 1, wherein the metal powder is copper powder, aluminum powder, a copper alloy powder, or a combination thereof.

12. The process of claim 1, wherein the metal precursor is an aluminum precursor powder or a copper precursor powder, and optionally, one or more powders are chosen from nickel precursor powders, manganese precursor powders, zinc precursor powders, and combinations thereof.

13. The process of claim 1, wherein the metal powder or metal precursor is present 95 to 99 wt.% (based on the total weight of metal powder or a metal precursor and graphene

material) in the dispersion.

14. The process of claim 1, wherein the graphene material is present 1 to 5 wt.% (based on the total weight of metal powder or a metal precursor and graphene material) in the dispersion.

15. The process of claim 1, wherein the ratio of metal powder or metal precursor weight to graphene material weight is 95:5 to 99: 1.

16. The process of claim 1, wherein the dispersant is water, a C1 to C6 alcohol, or a combination thereof.

17. The process of claim 1, further comprising isolating the nanocomposite from the dispersion.

18 The process of claim 1, wherein the graphene material is graphene, reduced graphene, graphene oxide, or a combination thereof.

19. The process of claim 18, wherein the graphene material is exfoliated graphene sheets, exfoliated reduced graphene sheets, or exfoliated graphene oxide sheets.

20. The process of claim 1, further comprising forming an ink comprising the nanocomposite.

21. The process of claim 20, further comprising forming a film using the ink.

22. The process of claim 21, wherein the film is formed by coating, printing, or additive manufacturing.

23. The process of claim 1, further comprising aligning the metal nanowires.

24. The process of claim 23, wherein the aligning comprises applying a shear force.

25. The process of claim 24, wherein the shear force is 3500 to 7000 kPa.

26. The process of claim 1, wherein the calcining is performed out at a temperature of 625 to 1110 K.

27. The process of claim 1, further comprising forming a pellet comprising the nanocomposite.

28. The process of claim 27, further comprising forming a wire from the pellet.

29. The process of claim 28, wherein the forming the wire comprises extruding the pellet.

30. A nanocomposite comprising a metal core and a graphene material layer disposed on at least a portion of a surface of the metal core or all of the surfaces of the metal core, wherein the metal core comprises copper, aluminum, a copper alloy, or a combination thereof,
wherein the graphene material is graphene, reduced graphene, graphene oxide, or a combination thereof,
wherein the graphene-material layer comprises 1 to 2 layers of graphene material, wherein the graphene-material layer has a thickness of 2 nm or less, wherein the graphene-material layer comprises a metal powder or a metal precursor and a graphene material and/or graphene-precursor material, wherein the metal powder is a nanopowder.

31. The nanocomposite of claim 30, wherein the graphene-material layer is at least partially continuous or completely continuous.

32. The nanocomposite of claim 30, wherein the graphene-material layer is a shell and the shell is at least partially continuous or completely continuous.

33. The nanocomposite of claim 30, wherein the nanocomposite is a wire, a film, or a pellet and exhibits one or more of
the following:

an electrical conductivity of 4 x 10^6 to 5.5 x 10^6 S/cm;

a breakdown current that is at least 10 times, 25 times, 50 times, 75 times, or 100 times that of the metal nanowires (without a graphene material layer); or

a Young's modulus of at least 2 times or 5 times that of the metal nanowires (without a graphene material layer).

34. A process of forming a conductive element of an electronic device:

forming the conductive element of an electronic device using an ink comprising a nanocomposite of claim 30; and

contacting the element of the electronic device with an aqueous organic acid solution or an organic solvent acid solution.

35. An article of manufacture comprising one or more nanocomposite of claim 30.

36. The article of manufacture of claim 35, wherein the article of manufacture is an electrical device, wherein the electrical device is an electrical motor, an electrical generator, a transformer, a switching regulator, converters, inverters, charging circuits, discharge circuits, a PCL control device, transmission units, distribution units, a battery device, or a battery power management device.

37. The article of manufacture of claim 35, wherein the article of manufacture is an electronic device, wherein the electronic device is a consumer electronic device a consumer electronic device, or a home appliance device, a solar cell, a wireless sensor device, a control device, an amplifiers, an attenuators, an Internet of Things (IOT) devices, a battery device, a battery charging device, a battery power management device, an audio device, an RFID device, or an illuminating device.

38. The article of manufacture of claim 35, wherein one or more component of an electrical device or electronic devices comprises the one or more nanocomposite, wherein the component is an antenna, contact, a conductor, a relay, a switch lead, or a radio frequency (RF) shield.