CLAIMS

1. An apparatus for applying an alternating electric field to a subject's body, the apparatus comprising:

a sheet of anisotropic material having a front face and a rear face, the sheet having a first thermal conductivity in a direction that is perpendicular to the front face, wherein thermal conductivity of the sheet in directions that are parallel to the front face is more than two times higher than the first thermal conductivity;

at least one layer of conductive material disposed on the front face of the sheet, wherein the at least one layer of conductive material has a biocompatible front surface; and

a first electrode element positioned behind the sheet, the first electrode element having a first front face disposed in electrical contact with the rear face of the sheet.

2. The apparatus of claim 1,

wherein the first electrode element comprises (i) a first layer of dielectric material having a front face and a rear face and (ii) a first layer of metal disposed on the rear face of the first layer of dielectric material,

wherein the front face of the first layer of dielectric material is the first front face of the first electrode element, and

wherein the apparatus further comprises a first rear layer of conductive material positioned between the first front face of the first electrode element and the rear face of the sheet, and wherein the first rear layer of conductive material facilitates the electrical contact between the first front face of the first electrode element and the rear face of the sheet.

3. The apparatus of claim 2, further comprising a second electrode element positioned behind the sheet, the second electrode element having a second front face disposed in electrical contact with the rear face of the sheet,

wherein the second electrode element comprises (i) a second layer of dielectric material having a front face and a rear face and (ii) a second layer of metal disposed on the rear face of the second layer of dielectric material,

wherein the front face of the second layer of dielectric material is the second front face of the second electrode element, and

wherein the first rear layer of conductive material is positioned between the second front face of the second electrode element and the rear face of the sheet, and wherein the first

rear layer of conductive material facilitates the electrical contact between the second front face of the second electrode element and the rear face of the sheet.

4. The apparatus of claim 2, further comprising a second electrode element positioned behind the sheet, the second electrode element having a second front face disposed in electrical contact with the rear face of the sheet,

wherein the second electrode element comprises (i) a second layer of dielectric material having a front face and a rear face and (ii) a second layer of metal disposed on the rear face of the second layer of dielectric material,

wherein the front face of the second layer of dielectric material is the second front face of the second electrode element, and

wherein the apparatus further comprises a second rear layer of conductive material positioned between the second front face of the second electrode element and the rear face of the sheet, and wherein the second rear layer of conductive material facilitates the electrical contact between the second front face of the second electrode element and the rear face of the sheet.

5. The apparatus of claim 1,

wherein the first electrode element comprises a piece of metal having a front face, and

wherein the front face of the piece of metal is the first front face of the first electrode element.

6. The apparatus of claim 1, wherein the sheet of anisotropic material is a sheet of graphite.

7. The apparatus of claim 1, wherein the sheet of anisotropic material is a sheet of pyrolytic graphite, graphite foil made from compressed high purity exfoliated mineral graphite, or graphitized polymer film.

8. The apparatus of claim 1, wherein the thermal conductivity of the sheet in directions that are parallel to the front face is more than ten times higher than the first thermal conductivity.

9. The apparatus of claim 1, wherein the at least one layer of conductive material comprises a conductive adhesive.

10. An apparatus for applying an alternating electric field to a subject's body, the apparatus comprising:

a sheet of anisotropic material having a front face and a rear face, the sheet having a first resistance in a direction that is perpendicular to the front face, wherein resistance of the sheet in directions that are parallel to the front face is less than half of the first resistance;

at least one layer of conductive material disposed on the front face of the sheet, wherein the at least one layer of conductive material has a biocompatible front surface; and

a first electrode element positioned behind the sheet, the first electrode element having a first front face disposed in electrical contact with the rear face of the sheet.

11. The apparatus of claim 10,

wherein the first electrode element comprises (i) a first layer of dielectric material having a front face and a rear face and (ii) a first layer of metal disposed on the rear face of the first layer of dielectric material,

wherein the front face of the first layer of dielectric material is the first front face of the first electrode element, and

wherein the apparatus further comprises a first rear layer of conductive material positioned between the first front face of the first electrode element and the rear face of the sheet, and wherein the first rear layer of conductive material facilitates the electrical contact between the first front face of the first electrode element and the rear face of the sheet.

12. The apparatus of claim 10, wherein the sheet of anisotropic material is a sheet of graphite.

13. A chemotherapeutic drug selected from one or more of temozolomide, pemetrexed, cisplatin, carboplatin, paclitaxel, nab-paclitaxel, doxorubicin, cyclophosphamide , trastuzumab, atezolizumab, gemcitabine, mebendazole, sorafenib, oxaliplatin, capecitabin, fluorouracil, Leucovorin, depatuxizumab mafodotin, and ABT-751, for use in treatment of a cancer selected from glioblastoma multiforme, lung cancer, malignant pleural mesothelioma, non-small cell lung cancer, brain metastases, breast

cancer, ovarian cancer, prostate cancer, pancreatic cancer, gastric cancer, gastroesophageal junction adenocarcinoma, gastric adenocarcinoma intestinal cancer, colon cancer, rectal cancer, liver cancer, hepatocellular cancer, and uveal cancer, wherein the chemotherapeutic drug is administered in combination with application of an alternating electric field having a frequency of 50 kHz to 1 MHz using electrode assemblies that include a sheet of anisotropic material.

14. The chemotherapeutic drug of claim 13, wherein the application of the alternating electric field is implemented by applying an alternating voltage between (i) a first electrode assembly that includes a first sheet of anisotropic material and (ii) a second electrode assembly that includes a second sheet of anisotropic material.

15. The chemotherapeutic drug of claim 13, wherein the chemotherapeutic drug is administered in further combination with administration of an immune checkpoint inhibitor.

16. The chemotherapeutic drug of claim 13, wherein the cancer is a glioblastoma multiforme, and the chemotherapeutic drug comprises temozolomide and is administered in further combination with pembrolizumab.

17. The chemotherapeutic drug of claim 13, wherein the chemotherapeutic drug is administered in combination with application of an alternating electric field having a frequency of 50 kHz to 1 MHz using electrode assemblies that include a sheet of graphite.

18. The chemotherapeutic drug of claim 13, wherein the application of the alternating electric field is implemented by applying an alternating voltage between (i) a first electrode assembly that includes a first sheet of anisotropic material having a first front face and a first rear face and (ii) a second electrode assembly that includes a second sheet of anisotropic material having a second front face and a second rear face, wherein thermal conductivity of the first sheet in directions that are parallel to the first front face is more than two times higher than thermal conductivity in directions that are perpendicular to the first front face, and

wherein thermal conductivity of the second sheet in directions that are parallel to the second front face is more than two times higher than thermal conductivity in directions that are perpendicular to the second front face.

19. The chemotherapeutic drug of claim 13, wherein the application of the alternating electric field is implemented by applying an alternating voltage between (i) a first electrode assembly that includes a first sheet of anisotropic material having a first front face and a first rear face and (ii) a second electrode assembly that includes a second sheet of anisotropic material having a second front face and a second rear face,

wherein the first sheet has a resistance in directions that are parallel to the first front face that is less than 1/2 of the resistance of the first sheet in directions that are perpendicular to the first front face, and

wherein the second sheet has a resistance in directions that are parallel to the second front face that is less than 1/2 of the resistance of the second sheet in directions that are perpendicular to the second front face.

20. An immune checkpoint inhibitor selected from one or more of pembrolizumab, nivolumab, cemiplimab, atezolimumab, durvalumab, avelumab, and ipilimumab for use in treatment of a cancer selected from glioblastoma multiforme, lung cancer, malignant pleural mesothelioma, non-small cell lung cancer, brain metastases, breast cancer, ovarian cancer, prostate cancer, pancreatic cancer, gastric cancer, gastroesophageal junction adenocarcinoma, gastric adenocarcinoma, intestinal cancer, colon cancer, rectal cancer, liver cancer, hepatocellular cancer, and uveal cancer, wherein the immune checkpoint inhibitor is administered in combination with application of an alternating electric field having a frequency of 50 kHz to 1 MHz using electrode assemblies that include a sheet of anisotropic material.