based systems do not possess a sufficient loading capacity and a sufficient deliverable capacity.

[0006] In view of these drawbacks, there is an unmet need for higher performance carbon adsorbent-based systems that operate in a safe and reliable manner.

Summary

[0007] In one aspect, a carbon adsorbent storage and dispensing system comprising a vessel and a structurally modified particulate carbon adsorbent disposed within an interior volume of the vessel, said structurally modified particulate carbon adsorbent comprising a synthetic polymer-based material, the structurally modified particulate carbon adsorbent further comprising particles having a particle size at or below 0.5 mm but no less than 0.15 mm, the structurally modified particulate carbon adsorbent further having modified structural characteristics to allow packing into the vessel as free flowing particles to generate a volumetric surface area (VSA) therewithin of greater than 800 m^2 of porous surface area per cc of a packed volume of the vessel, the structurally modified carbon adsorbent further configured to reversibly adsorb a dopant fluid that is stored at a storage pressure of less than 1 bar at 20 deg C.

[0008] In a second aspect, a carbon adsorbent storage and dispensing system comprising a vessel and a structurally modified particulate carbon adsorbent disposed within an interior volume of the vessel, said structurally modified particulate carbon adsorbent comprising a synthetic polymer-based material, the structurally modified particulate carbon adsorbent further comprising particles having a particle size at or below 0.5 mm but no less than 0.15 mm , the structurally modified particulate carbon adsorbent further having modified structural characteristics to allow packing into the vessel as a free flowing particles to generate a volumetric surface area (VSA) therewithin of greater than 800 m^2 of porous surface area per cc of a packed volume of the vessel, the structurally modified carbon adsorbent further configured to reversibly adsorb a dopant fluid that is stored at a storage pressure of less than 1 bar at 20 deg C, wherein said structurally modified particulate carbon adsorbent is characterized by a dispensing capacity

CLAIMS

1. A carbon adsorbent storage and dispensing system comprising a vessel and a structurally modified particulate carbon adsorbent disposed within an interior volume of the vessel, said structurally modified particulate carbon adsorbent comprising a synthetic polymer-based material, the structurally modified particulate carbon adsorbent further comprising particles having a particle size at or below 0.5 mm but no less than 0.15 mm, the structurally modified particulate carbon adsorbent further having modified structural characteristics to allow packing into the vessel as free flowing particles to generate a volumetric surface area (VSA) therewithin of greater than 800 m^2 of porous surface area per cc of a packed volume of the vessel, the structurally modified carbon adsorbent further configured to reversibly adsorb a dopant fluid that is stored at a storage pressure of less than 1 bar at 20 deg C.

2. The carbon adsorbent storage and dispensing system of claim 1, further comprising a tap bulk density ranging from to 0.45 to 0.7 grams of the structurally modified particulate carbon adsorbent per cc of the packed volume of the vessel .

3. The carbon adsorbent storage and dispensing system of claim 1, wherein the structurally modified particulate carbon adsorbent further comprises a specific surface area of at least 1000 m^2 of porous surface area per gram of the structurally modified particulate carbon adsorbent.

4. The carbon adsorbent storage and dispensing system of claim 1, wherein said structurally modified particulate carbon adsorbent comprises moisture and atmospheric impurities of no greater than 1 ppm in the aggregate.

5. The carbon adsorbent storage and dispensing system of claim 1, wherein the dopant fluid is arsine or phosphine.

6. The carbon adsorbent storage and dispensing system of claim 1, wherein the VSA of the structurally modified particulate carbon adsorbent ranges from 800 to 850 m^2 of porous surface area per cc of a packed volume of the vessel.

7. The carbon adsorbent storage and dispensing system of claim 1, wherein the particle size ranges from 0.15 mm to 0.2 mm.

8. The carbon adsorbent storage and dispensing system of claim 1, wherein the dopant fluid reversibly adsorbed onto the structurally modified particulate carbon adsorbent is arsine gas, whereby the storage and dispensing system is configured to dispense greater than 210 grams of the arsine gas per liter of the particulate carbon adsorbent.

9. The carbon adsorbent storage and dispensing system of claim 1, wherein the dopant fluid reversibly adsorbed onto the structurally modified particulate carbon adsorbent is arsine gas and the storage and dispensing system has a deliverable capacity of 300 grams per liter of the particulate carbon adsorbent or higher.

10. The carbon adsorbent storage and dispensing system of claim 1, wherein the dopant fluid is an arsine dopant gas and the size of the particles of the structurally modified particulate carbon adsorbent is at or below 0.5 mm but no less than 0.15 mm with a substantially microporous network defined, at least in part, by the VSA equal to or greater than 840m^2 of microporous surface area per cc of the packed volume of the vessel, and further wherein the structurally modified particulate carbon adsorbent is characterized by a deliverable capacity of the arsine to be greater than 210 grams of the arsine dopant gas per liter of particulate carbon adsorbent.

11. The carbon adsorbent storage and dispensing system of claim 1, wherein the dopant fluid is an arsine dopant gas that is reversibly adsorbed onto the particulate carbon adsorbent with a deliverable capacity of greater than 210 grams of the dopant per liter of structurally modified particulate carbon adsorbent.

12. The carbon adsorbent storage and dispensing system of claim 1, wherein the VSA of the structurally modified particulate carbon adsorbent has 900 m^2 or greater of surface area per cc of the vessel.

13. The carbon adsorbent storage and dispensing system of claim 1, wherein an overall porosity of the structurally modified particulate carbon adsorbent when packed into the vessel volume is substantially microporous.

14. The carbon adsorbent storage and dispensing system of claim 1 is in fluid communication with an ion implanter.

15. The carbon adsorbent storage and dispensing system of claim 1 configured to be loaded into a gas cabinet.

16. The carbon adsorbent storage and dispensing system of claim 1, wherein the structurally modified particulate carbon adsorbent comprises particles are substantially spherical shaped.

17. The carbon adsorbent storage and dispensing system of claim 1, wherein the structurally modified particulate carbon adsorbent comprises a packing density between 0.45 and 0.70 grams of the structurally modified particulate carbon adsorbent per cc of the packed volume of the vessel.

18. The carbon adsorbent storage and dispensing system of claim 1, wherein the VSA is greater than 800 and equal to or less than 950 m^2 of porous surface area per cc of the packed volume of the vessel .

19. The carbon adsorbent storage and dispensing system of claim 1 wherein the structurally modified particulate carbon adsorbent is composed of substantially spherical particles.

20. The carbon adsorbent storage and dispensing system of claim 1, wherein the structurally modified particulate carbon adsorbent further comprising a minimal amount of mesopores and macropores less than 10 vol% based on a total volume of solid pieces of the particulate carbon adsorbent as measured by mercury porosimetry.

21. A carbon adsorbent storage and dispensing system comprising a vessel and a structurally modified particulate carbon adsorbent disposed within an interior volume of the vessel, said structurally modified particulate carbon adsorbent comprising a synthetic polymer-based material, the structurally modified particulate carbon adsorbent further comprising particles having a particle size at or below 0.5 mm but no less than 0.15 mm , the structurally modified particulate carbon adsorbent further having modified structural characteristics to allow packing into the vessel as a free flowing particles to generate a volumetric surface area (VSA) therewithin of greater than 800 m^2 of porous surface area per cc of a packed volume of the vessel, the structurally modified carbon adsorbent further configured to reversibly adsorb a dopant fluid that is stored at a storage pressure of less than 1 bar at 20 deg C, wherein said structurally modified particulate carbon adsorbent is characterized by a dispensing capacity of 210 or more grams per liter of the structurally particulate modified carbon adsorbent when the dopant fluid is arsine.