

Claims

1. A method of supplying gas to a gas-utilizing process, said method comprising: providing a gas package including a gas storage and dispensing vessel containing a physical adsorbent and gas adsorbed on said physical adsorbent, and a valve head coupled to said vessel, said valve head including a valve that is actuatable for gas dispensing; actuating the actuatable valve in said valve head for gas dispensing, desorbing gas from the physical adsorbent, and dispensing gas from the vessel to said gas-utilizing process; wherein the physical adsorbent is a pyrolyzed monolith carbon physical adsorbent that is characterized by at least one of the following characteristics:

(a) a fill density measured for arsine gas at 25° C and pressure of 650 torr that is greater than 400 grams arsine per liter of adsorbent;

(b) at least 30% of overall porosity of said adsorbent comprising slit-shaped pores having a size in a range of from about 0.3 to about 0.72 nanometer, and at least 20% of the overall porosity comprising micropores of diameter < 2 nanometers; and

(c) a bulk density of from about 0.80 to about 2.0 grams per cubic centimeter.

2. The method of claim 1, wherein the adsorbent has been formed by pyrolysis and optional activation, at temperature(s) below 1000° C.

3. A method of supplying gas to a gas-utilizing process, said method comprising: providing a gas package including a gas storage and dispensing vessel containing a physical adsorbent and gas adsorbed on said physical adsorbent, and a valve head coupled to said vessel, said valve head including a valve that is actuatable for gas dispensing; actuating the actuatable valve in said valve head for gas dispensing, desorbing gas from the physical adsorbent, and dispensing gas from the vessel to said gas-utilizing process; wherein the physical adsorbent comprises a monolithic carbon physical adsorbent that is characterized by at least one of the following characteristics:

(a) a fill density measured for arsine gas at 25° C and pressure of 650 torr that is greater than 400 grams arsine per liter of adsorbent;

(b) at least 30% of overall porosity of said adsorbent comprising slit-shaped pores having a size in a range of from about 0.3 to about 0.72 nanometer, and at least 20 % of the overall porosity comprising micropores of diameter <2 nanometers; and

(c) a bulk density of from about 0.80 to about 2.0 grams per cubic centimeter;

wherein the gas comprises a gas selected from the group consisting of arsine, phosphine, hydrogen selenide, hydrogen telluride, nitrogen trifluoride, boron trifluoride, boron trichloride, diborane, trimethylsilane, tetramethylsilane, disilane, silane, germane, and organometallic gaseous reagents.

4. The method of claim 3, wherein said gas-utilizing process comprises a semiconductor manufacturing process.