STANDARD TEST METHOD

SPECIFIC GRAVITY OF SOLIDS & POWDERS

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SCOPE:

This procedure specifies a method for the measurement of the density (or specific gravity) of solid and powdered materials. This method is based on ISO1183-3:1999(E). It is relevant to materials which do not contain closed pores.

APPARATUS:

1. Gas Pycnometer - (Quantachrome Stereopycnometer Model Spy-2).
   Figure 1 is a schematic of a gas pycnometer of the type used at FMP.
2. Analytical Balance accurate to 0.01 g.
3. Measurement Gas - Helium.

PROCEDURE:

1. If required - dry test specimens to constant mass before testing. Ensure that the drying conditions used do not result in changes to the density of the material.
2. Purge the apparatus with the measurement gas, allow the gas to reach atmospheric pressure and zero the pressure transducer.
3. Close valves V1, V2 & V3
4. Place a test specimen of known mass into the measurement cell.
5. Open valve V1 and allow the measurement gas to flow into the measurement chamber until the desired pressure is reached and then close valve V1. Allow the pressure to reach equilibrium (p_1)
6. Open valve V2 and allow the gas to expand into the expansion cell. Allow the pressure to reach equilibrium (p_2)

The volume of the test specimen (Vs) is determined by:

$$Vs = Vmeas - \frac{V\exp}{\frac{p_1}{p_2} - 1}$$

The density (ρ) can be calculated by dividing the mass of the specimen by its volume:

$$\rho = \frac{mass}{Vs}$$

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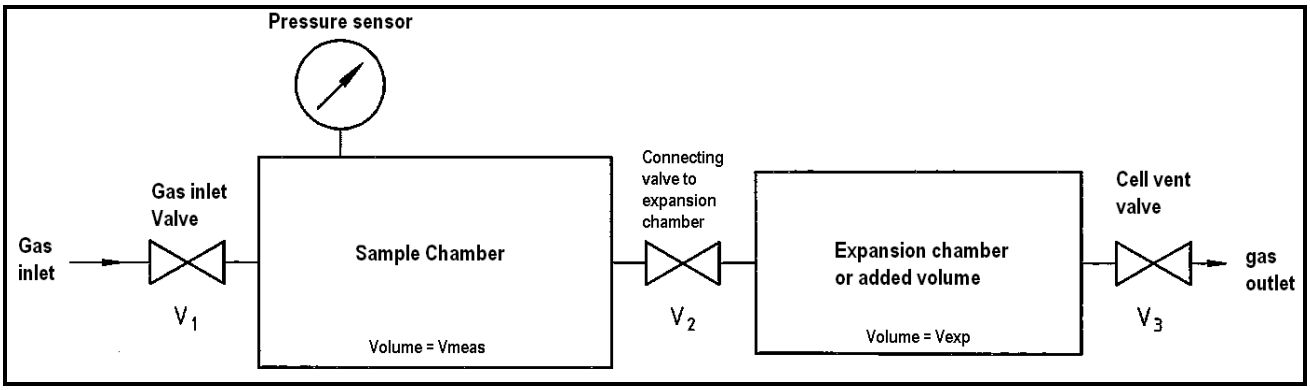

Figure 1.

Quantachrome Stereopycnometer Model Spy-2 Operating Method:

1. Ensure this piece of equipment has been calibrated within the last 6 months.
2. Turn on power to pycnometer and allow pressure transducer to warm up and stabilize for 30 minutes.
3. Turn on the helium and adjust the pressure regulator to 140 kPa.
4. Open all valves and allow the helium gas to purge the system for 30 – 60 seconds.
5. Close the "FLOW" toggle and the "FLOW CONTROL" valve.
6. Wait for the digital display to stabilize.
7. Zero digital display
8. Remove the sample cup (aluminium cup), by rotating the black plastic cover on top of the sample cell counter-clockwise.
9. Weigh the cup, fill with sample (3/4 full) and reweigh. Determine the sample weight by difference.
10. Seal the sample cup in the sample cell making sure the o-ring is secured in the groove in the inside top of the sample cell cover. Secure the seal by rotating the black plastic cover clockwise on the threads of the sample cell until metal to metal contact is made.
11. Wait for stable zero reading.
12. Turn selector valve to "VA OUT".
13. Close the "CELL VENT".

14. Open the "FLOW" toggle and allow the sample chamber to pressurize. The "FLOW CONTROL" needle valve can be used to control the rate of pressurization. When the pressure value has stabilized to a value of **18 PSI**, close the "FLOW" toggle valve. Note: Do not let the pressure reach more than 20 PSI.
15. Record display reading when stabilised. This value is "P2" in the equation.
16. Turn selector valve to "VA IN".
17. Record display reading when stabilised. This value is "P3" in the equation.
18. Vent pressure slowly to prevent blowing powder out of the cell, by opening "CELL VENT" with the "CELL VENT CONTROL" slightly open.
19. To calculate the volume of the sample, use the equation:

$$V_P = V_C + \frac{V_A}{1 - {}^{P2}\!/_{P3}}$$

V_P = Sample volume (cm3)
V_C = Sample cell volume (The large cell volume is = 155.99 cm3.)
V_A = Added volume = 87.40 cm3.

20. To calculate the density of the sample, use equation:

$$\rho = \frac{w_p}{V_P}$$

w_p = sample weight

Note:

More frequent recalibration may be necessary if dirt/dust is in the system. Refer to instruction manual for the calibration procedure.