pressure of sulfur at 400°C. γ_V for this compound would be very difficult to measure by conventional pyknometric methods.

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Refrigerating Vapor Bath

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A simple and inexpensive refrigerating vapor bath has been developed for the purpose of cooling gas line traps. The cooling medium in the bath is the cold vapor from liquid nitrogen. The temperature regulation range is from −196 to ~0°C. For a glass-isolated stainless steel gas trap the liquid nitrogen consumption rate was less than ½ liter/24 h at temperatures between −130 and −196°C.

INTRODUCTION

Many techniques have been developed to meet the varied refrigeration requirements that arise in the laboratory; the specific requirement addressed in this paper is that of refrigerating a gas line trap.

Most laboratories which employ gases for research purposes arrange to have the gas flow through one or more cold traps which serve to reduce impurities in the gas. By far, the most common refrigerant in use for cold traps is that made in the form of a chemical slurry. The simplicity and economy of this refrigerant make it popular in spite of its deficiencies, which are, to name a couple, discrete temperatures and tedious time consuming maintenance.

Several elaborate variable-temperature devices have been developed for more sophisticated refrigeration requirements, e.g., liquid H_2 and He cooling of samples to be used in studies on liquid hydrogen targets,[1] EPR,[2] electron bombardment,[3–5] and cathodoluminescence.[6] However, the refrigerating vapor bath (RVB), described herein, is designed to fill a greater, more broad based need than those references above[1–6]; i.e., it is intended to provide a simple, inexpensive, and convenient means of achieving dialable temperatures for a gas line cold trap. The features of the RVB make it an attractive and effective replacement for the chemical slurries so widely used for this purpose. Accordingly, this paper is written as a "how-to" paper, indicating principles of operation, construction, assembly, and liquid nitrogen consumption rate for typical operating conditions.

APPARATUS DESCRIPTION

The RVB utilizes cold vapor from a reservoir of liquid nitrogen as the heat transfer medium. By varying the vapor density and temperature, the rate of heat loss from the gas trap can be controlled. Figure 1 is a schematic diagram of the apparatus. The charge of liquid nitrogen (LN_2) (1) is placed in Dewar (2). The stainless steel gas trap (3) is suspended above the refrigerant surface. The Dewar is closed with a seal (4) and the trap temperature is sensed by a Cu/Cn thermocouple (5).

The trap temperature will equilibrate at a point determined by the balance of heat transfer into and out of the Dewar. The heat transfer into the Dewar is primarily determined by thermal conduction of the signal and power leads passing through the seal (4), conduction down the walls of the Dewar, and the gas load on the trap. The molecules in the cold vapor serve to remove heat from the trap and transfer it to the liquid reservoir. Heat loss from the bath is regulated through evaporative cooling of the LN_2 reservoir—the vapor being released through a valve (6) in the seal of the Dewar.

There are two ways in which the RVB may be operated, depending upon whether the equilibrium temperature of