

# CRYOSTAT

## QUANTACHROME INTRODUCES NEW CRYOSTAT FOR AUTOSORB-1 GAS SORPTION ANALYZERS

A customized Optistat<sup>®</sup> DN cryostat has been developed specially for Quantachrome Instruments' Autosorb-1 analyzers, in cooperation with OXFORD Instruments (Abingdon, U.K.). The new device, using only liquid nitrogen as coolant, allows gas adsorption experiments to be performed over a wide range of temperatures, from 77 K to 200 K.

This advance in sorption capability will allow scientists to readily make the following measurements - without the usual restriction of a limited number of specific temperatures afforded by baths of different cryogenic liquids or melting solids:

- High resolution micro/mesopore analysis by argon adsorption at 87 K (*without expense of liquid argon!*)
- Adsorption measurements over a wide range of temperatures with various adsorptives (i.e. alternatives to argon, nitrogen and krypton adsorption)
- Accurate determination of isosteric heat of adsorption (which requires measurement of multiple isotherms each at a different temperature).

### Technical Specifications

- Temperature range  
77 K - 200 K
- Temperature stability  
 $\pm 0.03\text{K}$  using an ITC controller (measured over a 10 min period)
- Heat exchanger fitted with heater and platinum temperature sensor
- Additional 3pt calibrated RhFe temperature sensor in sample space
- 1.8 l nitrogen reservoir
- Cool down time from room temperature  $\approx 20$  min
- Liquid nitrogen hold time  $\geq 24$  hr



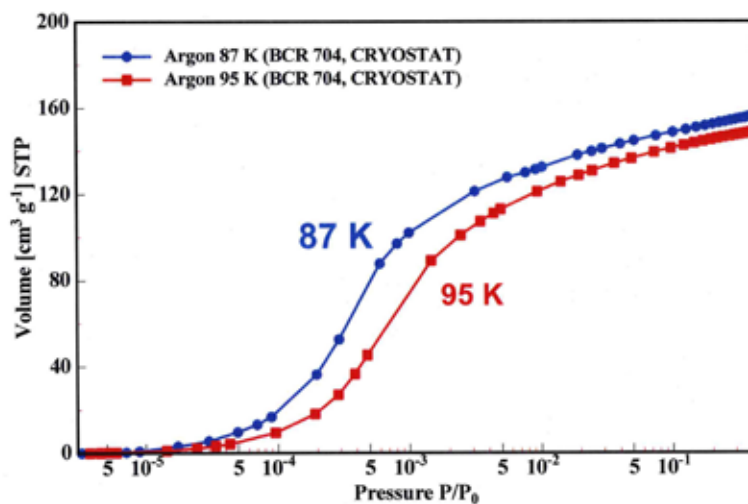
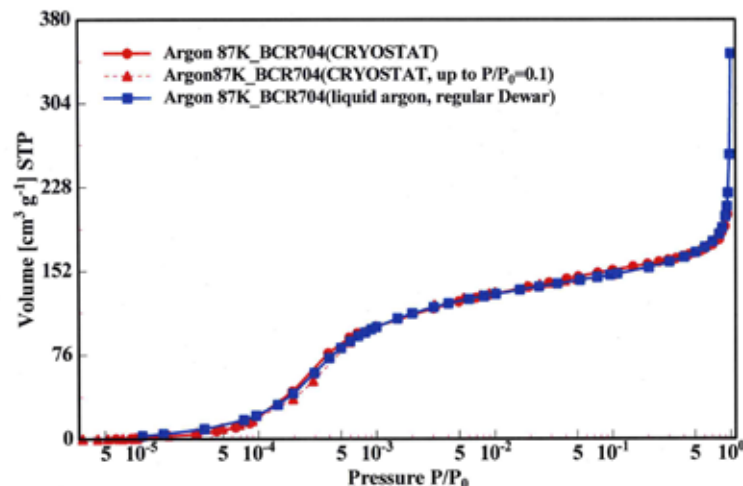
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# CRYOSTAT FOR AUTOSORB-I

Cryostat performance is demonstrated in the argon adsorption isotherm graphs to the right; the sample studied was BCR 704, a microporous certified reference material (CRM) released by IRMM. The results shown in the top figure are for argon adsorption measured at 87.5 K (the normal boiling point of liquefied argon) (i) using liquid argon as coolant in a standard dewar and (ii) twice at the same temperature using liquid nitrogen (normal boiling point 77.4 K) in the cryostat. The results are in agreement with the specification for this CRM, and highly repeatable.

The bottom graph shows the results for the same material measured at 87K and 95 K using liquid nitrogen coolant in the cryostat. The isotherm obtained at 95 K agrees with the theoretical expectation that pore filling shifts to higher relative pressures and that the adsorbed amount reduces with increasing temperature because of the lower density of the adsorbed phase at the higher temperature. The micropore volume obtained from the argon adsorption experiment at 95.2 K agrees well with the micropore volume obtained from the 87.5 K run.



\* IRMM; Institute for Reference Materials and Measurements, one of seven institutes of the Joint Research Center, a Directorate-General of the European Commission.

[http://irmm.jrc.ec.europa.eu/html/reference\\_materials\\_catalogue/index.htm](http://irmm.jrc.ec.europa.eu/html/reference_materials_catalogue/index.htm)

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