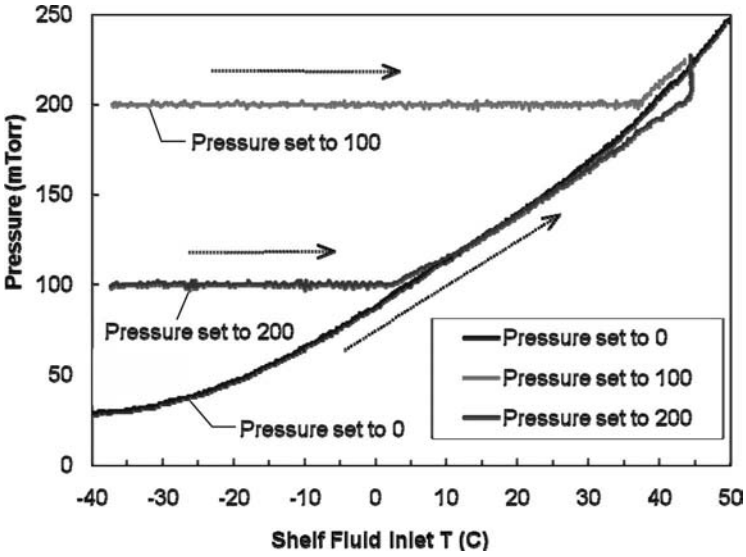

FIGURE 2 Ice slab sublimation data for a laboratory-scale freeze-dryer.

sublimation exceeded the ability of the freeze-dryer to transport it to the condenser chamber and to condense it as ice on the condenser coils. Note that for the 100-mTorr set-point case, the shelf fluid inlet temperature at which this occurred is about the same as for the case in which the chamber pressure was set to 0. And for the 200-mTorr set-point case, the shelf fluid inlet temperature at which that set point was exceeded was approximately the same as for when the 0 mTorr and 100 mTorr cases reached 200 mTorr. The key to understanding this is that the point of departure from the pressure set-point is the time when the flow rate of purge gas has also decreased to zero. The condenser pressure reached 20 mTorr, suggesting choked flow, and the Pirani pressure gauge reading decreased to equal that of the capacitance manometer, confirming that nitrogen was no longer being injected into the chamber as a purge gas.

One can observe from the figure that it is unnecessary to make *separate* measurements of the shelf fluid inlet temperature required to achieve chamber pressure failure at a range of separate pressures (e.g., 100 and 200 mTorr in this case). Rather, a continuous shelf fluid inlet temperature ramp with the chamber pressure set to zero will provide a continuum of shelf fluid inlet temperatures and their corresponding pressures. Therefore, routine testing can be streamlined by conducting part A with the purge gas turned off (chamber pressure set to zero).

Part A of Ice Slab Studies

1. Tape a thermocouple to the top surface of each shelf, at least 0.5 m from the tray ring edges.
2. Load a tray ring with attached plastic sheeting onto each shelf. The sheeting (or film) should be as thin as possible (0.002 in. or less). The tray rings should cover as much as the shelves as possible.