

Sodium and potassium were not difficult to handle under oil. After the Deo Base had been purified by reacting alkali chips with it, reasonably clean surfaces could be maintained. These metals, as well as lithium, were soft enough to allow sheets of thickness from .007 inch to .035 inch to be made using a small adjustable set of rollers.

The lithium and potassium were cleaned by heating to above the melting point under forepump vacuum. The sodium was cleaned by melting it under oil. Chunks of the metal were placed in a small stainless steel boat about 1/2" by 1/2" by 3" long. Inclusions of oxide or dirt rose to the top of the ingot and could be removed. Better purification using distillation was not considered necessary since the metal surface would suffer some oxidation as soon as it was placed in oil. We were concerned with producing samples that were macroscopically homogeneous, but not necessarily pure in the sense of having low residual resistance. As long as the impurity scattering was small compared with the lattice scattering at room temperature, the sample was "pure" as far as we were concerned. The lithium was obtained from Fairmount Chemical Co., the sodium from Merck and Co., and the potassium from Mallinckrodt Chemical Co.

Rubidium and cesium were considerably more difficult to handle than the other alkalis. These metals, sealed in one gram glass vials, were obtained from A. D. MacKay Co. and Fairmount Chemical Co. We initially tried to remove the metal from the vials by placing them in a heater and letting the molten liquid flow out under oil. This was not satisfactory as we obtained several small globules of metal, each of which was too small to make a sample. If we pressed several globules together the resulting sample would have an oxide film inside it.

These metals oxidized rapidly even when kept under oil at room temperature. Furthermore, the oxide was soluble in the metal [15]. As oxide formed, it dissolved in the pure metal forming an alloy which was liquid at room temperature.

The final solution was to make the rubidium and cesium samples in chilled oil. The tray containing the Deo Base was placed on a block of polyfoam which had been hollowed out and filled with dry ice. The oil in the

tray was maintained at a temperature of $0^{\circ}\text{C} - 5^{\circ}\text{C}$. Both the Deo Base and the pressure transmitting fluid, pentane, were purified by reacting them with globules of sodium-potassium alloy, a liquid. The metal was removed from the glass vial by pushing it out with a small formica rod. The slugs of metal obtained were molded by hand, using gloves, to approximately the shape and size needed, placed on the sample holder and contacts made while the metal surface was still clean. The surface generally had a dull silver-gray color, indicating some oxidation. Unoxidized rubidium and cesium have a bright silver color, while metal immersed in uncleaned oil would become black. The sample surface was further protected by placing some silicone stopcock grease on it and then covering it with a sheet of .003 inch Mylar plastic, the latter held down by the screws which tightened the current contacts. The sample was transferred to the bomb in the same way as the other alkalis.

D. Measurements as a Function of Temperature

The temperature measurements on lithium were made using a glass dewar with 2 inch O.D. and 1-1/2 inch I.D. and the unit shown in Fig. 2-7. The unit fitted inside the dewar and a seal was made at the top using a rubber gasket made from a plurostopper[†]. The region above the liquid nitrogen and around the glass tube formed a closed chamber which could be connected to a mechanical pump. By pumping on the liquid nitrogen it could be cooled below its freezing temperature, to about -216°C . The region above the glass tube was sealed using the brass plate and an "O" ring. It was pumped out and filled with helium exchange gas. A formica rod, one end of which was made into a sample holder similar to the pressure one, screwed onto the top brass plate. A heater, consisting of a piece of copper tubing wound with resistance wire, fitted around the sample holder. The temperature was measured using a copper-constantan thermocouple located at the sample. Temperatures below -196°C were measured by calibrating our thermocouple at the nitrogen point and using the value $dE/dT = 16$ microvolts/ $^{\circ}\text{C}$ given by Scott [16] for the thermoelectric power at -196°C . The electrical connections were

[†] Available from Bethlehem Apparatus Co., Hellertown, Penn.