Notes

BRIEF contributions in any field of instrumentation or technique within the scope of the Journal can be accorded earlier publication if submitted for this section. Contributions should in general not exceed 500 words.

Vacuum Seals at Liquid-Nitrogen Temperature*

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IT is often necessary to make vacuum seals which will hold at liquid-nitrogen temperature, and with many materials soldering or welding is impossible or very difficult. For sealing to, among other materials, aluminum, molybdenum, and tungsten, the H. B. Fuller Company's[1] Resiweld Adhesive #4 has been found to be satisfactory. It is an epoxy resin with the usual two component mixture. It has been used primarily to seal foils to holders, and for this purpose has been used in the "stiff" mixture described in the instruction sheet which comes with the adhesive. The seal has very little structural strength at low temperature and should not be subjected to stress, such as evacuation or letting in of air while at low temperature. McClintock and Hiza[2] have measured the strength of epoxy-resins at low temperature and found it very low, especially in shear. At room temperature, however, the seal is fairly strong and has been used for many cementing applications. Resiweld has been found unsatisfactory for sealing to plastics. No attempt has been made to find the vapor pressure, but as no solvent is involved, it probably is not too high. Epstein[3] recommends Monsanto #AT-7 and Narmco Metlbond MN3C for low-temperature adhesion. It is not known if either of these is good as vacuum seals. We would like to thank Dr. R. J. Cashman and Mr. A. H. Joseph for suggesting the possible use of epoxy-resin in this application.

O-rings made of Kel-F Elastomer[4] have also been found satisfactory at liquid nitrogen temperature, although the largest which has been used here is $\frac{3}{4}$-in. o.d. The groove must be such that the compression of the O-ring will not exceed 7% of the cross-sectional diameter; e.g., for the 0.100-in. cross section O-ring a 0.093-in. deep groove is used thereby compressing the O-ring 0.007-in. The inside diameter of the groove should be the actual, not the nominal, inside diameter of the O-ring. The seal should be bolted together tightly at low temperature.

Kel-F O-rings are not very flexible and tend to develop flats with use; however, one has been used at liquid-nitrogen temperature, the seal disassembled, reassembled, and again used, with no leak detectable on a Consolidated Electrodynamics mass spectrometer leak detector. It is, however, advisable to replace the O-ring when disassembling the seal. A seal has also been cycled between liquid-nitrogen and room temperatures by plunging it first in nitrogen and then in warm water and leak testing each time, with no leak detected after 10 cycles.

The Kel-F O-ring has the advantages over metal O-rings in that (1) it is commercially available, (2) it can, if necessary, be re-used, and (3) it required only normal O-ring groove machining.

* Work supported in part by the U. S. Atomic Energy Commission through the Argonne National Laboratory subcontract.
[1] The H. B. Fuller Company, St. Paul, Minnesota. Sample kits are available for $1.00.
[2] R. M. McClintock and M. J. Hiza, National Bureau of Standards, Cryogenic Engineering Laboratory, Boulder, Colorado Report #5039.
[3] George Epstein, *Adhesive Bonding of Metals* (Reinhold Publishing Corporation, New York, 1954).
[4] Available from the Garlock Packing Company, P. O. Box 43, Camden, New Jersey, at about 50¢ each.

Field Sources of Blackbody Radiation*

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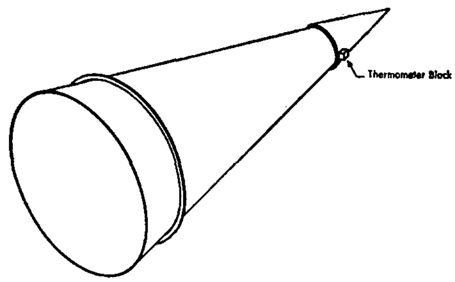
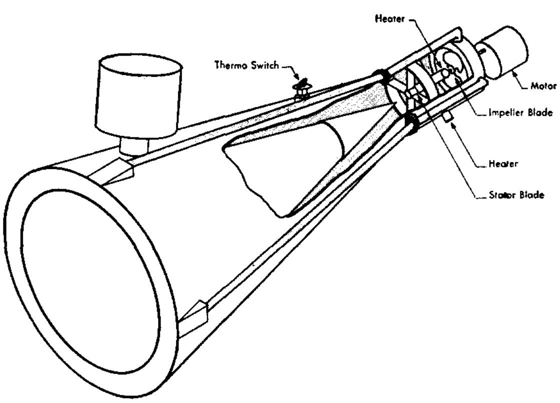
IN field measurements of infrared radiance distributions by radiometric means, a common practice is to place two or more temperature-controlled sources of blackbody radiation in close proximity to the objects under study. During an experimental program of this type which was carried out by this laboratory, the need arose for large-area thermal radiation sources which would serve this purpose, and which might also be used for field calibration of the radiometric equipment.

Specifically, sources of blackbody radiation were required with an area of about one square foot, an emissivity

FIG. 1. Conical field sources.



(a)



(b)

FIG. 2. (a) Ambient-temperature conical field source; (b) temperature-controllable conical field source.

as close to unity as could be realized, and an accurately controllable temperature selectable within the range 10 to 90°C. Since the program involved measurements by day as well as at night, the emissivity requirement was of special importance. The use of flat tanks containing water with electrical heaters and stirrers was found lacking in this respect even when the surfaces were prepared with Siconblack enamel coatings yielding emissivities of 0.93 ± 0.03 in the wavelength interval between 1 and 15 μ. The emissivity of this enamel, manufactured by Midland Industrial Finishes, Waukeegan, Illinois, was measured with a Perkin-Elmer, Model 112, spectrometer with White Reflectometer attachment. Sunlight reflections in daytime use, and even the effects of radiation from the sky at night, were found to preclude satisfactory constancy of the radiation from these sources, although the uniformity of temperature across the surface was within two degrees centigrade.[1]

Two such sources, an ambient-temperature conical field source and a temperature-controllable conical field source, were designed and constructed.[2] These are shown in Fig. 1. One consists of a simple metal cone [shown in Fig. 2(a)] coated internally with the black enamel. This source quickly assumes the ambient air temperature and is not temperature-controlled. Monitoring is done by means of thermometer mounted so as to insure good thermal contact. Checks with surface pyrometers at several points of the inside of the cone showed the temperature distribution to be uniform to within $\frac{1}{2}$°C or less.

The temperature-controllable source consists of a similar cone with a water jacket. Provision is made for circulation and heating of the water as is shown in Fig. 2(b). The particular impeller design shown was evolved from a series of designs and allows temperature uniformity of 1°C from the rear to the front of the cone as well as from top to bottom of the front portion of the source at an average temperature of 50°C.

Although no accurate experimental determinations have been made of the emissivity of the conical field sources, calculations have been made using the methods of DeVos[3] as applied to a conical source by Edwards.[4] The resulting value of 0.99 leads to the assumption of an emissivity of unity for most field uses of these sources.

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[1] The invaluable assistance of Mr. Neufang, Mr. Fisher, and Mr. Sibson of this laboratory in the construction and testing of the sources described herein is gratefully acknowledged.
[2] These sources were described in: "Calibration Procedures Used at IRMP," by A. LaRocca and G. Zissis published in *Proceedings of IRMP Symposium 1956*, WADC Report 57WCLR-2647 (April, 1957).
[3] J. C. DeVos, Physica **20**, 669 (1954).
[4] D. F. Edwards, "The Emissivity of a Conical Blackbody," University of Michigan ERI Report No. 2144-105-T (1956).

Precision Chuck and Chip Catcher for Sectioning Diffusion Samples*

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THE chucks used for diffusion specimen sectioning are designed to facilitate the exact alignment of the specimen face perpendicular to the lathe axis. The present design (Fig. 1) is a modification of one by Tomizuka.[1] The changes allow easier handling of small specimens, quantitative chip recovery while machining under a protective atmosphere, and more sensitive adjustment.

The jaw assembly (1) from a small three-jaw chuck[2] is fastened to the chuck adapter plate (2) which has a spherical radius machined on the back. The convex spherical segment is mated with a concave one machined into the head stock bar (3), which can be held in a chuck or a $\frac{3}{4}$-in. collet. To line up the specimen, the chuck adapter plate is tilted with respect to the lathe axis by four screws (4) that thread into the adapter plate. Mating spherical washers (5) keep the thrust of each screw normal to the head stock bar plate. The radius of curvature on the chuck adapter plate is such that the center of curvature is near the front face of the specimen (6). This makes the adjustment quite