the −60 to +80° C. range the coefficients would be incompatible.

CONCLUSIONS

New absolute thermal conductivity measurements for A.R. and B.P. quality benzene, ethyl bromide, ethyl iodide, toluene, and trichloroethylene have been presented. The body of data for each fluid has been analyzed by the method of least squares to yield a linear equation of the form $\lambda = A + Bt$ for the thermal conductivity over the temperature range 15° to 80° C. The data presented provide a useful addition to the available data adding confirmation and extending the data of Riedel, Schmidt and Liedenfrost, Horrocks and McLaughlin, and Ziebland.

The temperature coefficients of thermal conductivity for ethyl bromide and ethyl iodide have been measured over the range of 15° C. to their normal boiling points. Serious discrepancies arise in the comparison of this work to that of Powell and Tye, and it is thought that the comparator method used by them is possibly in error owing to the reaction and subsequent softening of the plastic membrane used with these fluids.

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Coefficients of Thermal Expansions of Alloys at Low Temperatures

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The interferometric method was used to determine linear thermal expansion coefficients of Monel, 1020 low carbon steel, 410 stainless steel, and yellow brass from 18° to 300° K.

LINEAR thermal expansion coefficients have been determined in the temperature interval from approximately 18° to 300° K. for the four alloys, cold rolled free cutting "R" Monel, 1020 low carbon steel, 410 stainless steel, and yellow brass ASTM B 16. The apparatus and experimental technique are the same as described for the thermal expansion of copper (*10*).

The alloys were obtained from commercially available bar stock. The Monel and yellow brass were obtained from the Columbus Ohio supplier, Williams and Co. The other alloys were supplied by the Carnegie-Illinois Steel Co. The samples were used without further heat treatment. Each sample consisted of three sectors cut from the bar, filed to the same length (within ⅕ of the wave length of sodium D

Table I. Smooth Values of Coefficients of Thermal Expansion

$\alpha \times 10^5$

Monel	1020 Low carbon steel	T., ° K.	410 Stainless steel	Yellow brass
1.390	1.185	300	1.036	1.910
1.375	1.167	290	1.024	1.896
1.360	1.149	280	1.011	1.881
1.344	1.131	270	0.998	1.865
1.328	1.113	260	0.984	1.849
1.311	1.095	250	0.970	1.832
1.293	1.076	240	0.955	1.814
1.274	1.056	230	0.939	1.796
1.253	1.035	220	0.922	1.778
1.229	1.014	210	0.903	1.760
1.203	0.992	200	0.882	1.741
1.175	0.967	190	0.859	1.719
1.145	0.939	180	0.834	1.694
1.112	0.907	170	0.806	1.665
1.076	0.871	160	0.774	1.631
1.036	0.830	150	0.738	1.591
0.992	0.784	140	0.697	1.544
0.943	0.733	130	0.650	1.493
0.888	0.677	120	0.596	1.437
0.825	0.616	110	0.534	1.370
0.752	0.550	100	0.466	1.286
0.667	0.478	90	0.395	1.183
0.568	0.399	80	0.321	1.063
0.455	0.313	70	0.244	0.924
0.342	0.227	60	0.164	0.764
0.233	0.144	50	0.092	0.577
0.137	0.076	40	0.043	0.367
0.064	0.034	30	0.017	0.175
0.020	0.012	20	0.006	0.052

radiation), and confined between two optical flats. This configuration of optical flats and sample was the parallel plate Fizeau interferometer.

RESULTS

Absolute values of the linear expansion coefficient were determined as described in (*1*). The results were plotted on large scale plots, and values were picked from these plots at even temperatures. These are shown in Table I. All temperatures were determined by means of a standardized thermocouple.

ERRORS

The thermocouple was calibrated in terms of the Ohio State University Cryogenic Laboratory temperature scale (*11*). These temperatures are known to 0.03° K., and temperature intervals are known to 0.01° K. Deviations in the length determinations are of the order of 0.009 fringe. The corresponding error in the expansion coefficients is about 0.4% above 90° K. and increases gradually to approximately 10% at about 18° K.

For this temperature range, there has been much work concerning the expansion coefficients and integral expansions for these substances. For brass, expansion coefficients have been measured by Hennings (*6*) and Johansson (*7*), and integral expansions by Beenaker and Swenson (*3*). Integral expansions of brass have been measured also by Fraser and Hollis-Hallet (*4*) and Keyston, McPherson, and Guptil (*8*). For Monel, thermal expansions (differential or integral) have been measured by Ackerman (*1*), Krupkowski and de Haas (*9*), and Aoyama and Ito (*2*). Thermal expansions for 1020 steel have been measured by Gregg (*5*) and Beenaker and Swenson (*3*).

There appear to be no data available for 410 stainless steel in this temperature range.

For brass and 1020 steel, the integral expansion data of Beenaker and Swenson agree with those of the present work to within 3% for all parts of the temperature scale. The results of all authors (*1, 2, 4, 5, 8, 9*) for any of the alloys agree within 3% and often within 1% of the present data for temperatures above 90° K. However, they deviate seriously below 90° K., sometimes to the order of 20%. Generally, the currently determined values are the smaller.

Undoubtedly, one of the reasons for such large deviations can be differences among the temperature scales employed. However, Krupkowski and de Haas have used the excellent Leiden temperature scale but their alloy (a Monel) does not contain the traces of iron and manganese present in the commercial Monel. In this case, the present data have greater magnitudes than expansion data of Krupkowski and de Haas.

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