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DISCUSSION

J. E. S. Venart[2]

Drs. Bishnoi and Robinson provide an interesting and valuable discussion of the available methods of determining absolute and relative values of enthalpy change and specific heat. It is perhaps unfortunate that the title does not adequately reflect the fact that the determined thermal property is to be the heat capacity ratio. Nevertheless, the description and testing of instruments capable of high precision is especially relevant to present day industry whose evaluation and design methods employ large data banks of sometimes questionable and outdated data. With the increased scale of present day and projected operations, the importance of more accurate thermodynamic and transport property data does not need any justification—it is by means of such data that competent plant evaluation and design are carried out.

Accurate utilization of the method requires choosing small pressure and temperature drops through the exchanger under conditions of both heating and cooling such that for heating [2]

$$\frac{Cp}{Cp_0} = -\frac{T_4 - T_3 + \mu_0(p_3 - p_4)}{T_2 - T_1 + \mu(p_1 - p_2)} + \frac{q}{Cp_0[T_2 - T_1 + \mu(p_1 - p_2)]} \quad (4)$$

Equations (2) and (3) of the paper immediately follow provided the variations in μ, Cp, and Cp_0 can be assumed linear. This later assumption not only restricts measurements to small pressure and temperature drops but also to single phase behavior remote from the phase boundaries.

In the calorimeter construction it is most important to prevent thermal exchange between the inlets of both the high and low pressure streams prior to measurement since the maximum temperature difference exists at these points. The nonsymmetry of the two extrapolated $\Delta T_0/\Delta T$ curves about unity at a pressure equal to that of the low pressure stream will be an indicator of any such errors—their agreement to within ±0.5 percent is gratifying. It would however have been very useful to utilize various stream temperature differences to obtain several mean curves for one mean temperature so as to critically examine the reproducibility and randomness of the behavior.

In summary, this paper provides the description of method and performance of an exceptionally precise instrument for the determination of heat capacity ratios.

Authors' Closure

The points made by Dr. Venart in his discussion are well taken. His comments concerning the linear variation in μ, C_p, and C_{p_0} are the basis for our choosing small pressure and temperature drops. We did not use various stream temperature differences to obtain several mean curves for one mean temperature because we did not feel justified in spending the excessive time required to do so in view of the very small error obtained when the $\Delta T_0/\Delta T$ curves were extrapolated to zero pressure.

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