Int. J. Heat Mass Transfer. Vol. 26, No. 12, p. 1893, 1983
Pergamon Press Ltd. Printed in Great Britain

LETTER TO THE EDITORS

COMMENTS ON 'HEAT TRANSFER WITH CONTACT RESISTANCE'

IT WAS interesting to read the article by Shai and Santo [1] who deal with the resistance to heat flow associated with a conical constriction. They consider the particular case wherein the heat flow through the fluid surrounding the constriction is neglected, i.e. the constriction is assumed to be in a vacuum.

Finite difference numerical solutions are available for the heat flow through conical constrictions in vacuum as well as in conducting media [2, 3]. These analyses show that:

(1) The constriction resistance reduces significantly due to the presence of a conducting fluid, especially at the practically important low radius ratios (ε). This conclusion is true even if the fluid is a comparatively poor conductor such as air.

(2) As the cone semi-angle γ is increased, the constriction resistance is decreased, approaching asymptotically the disc constriction resistance of Mikic [4]. In fact, for values of γ greater than about 80° (cot $\gamma < 0.18$), there is virtually no difference between the conical and the disc constriction resistances.

The second of the above conclusions is confirmed by the work of Shai and Santo [1]. The discussor would be interested to know whether the authors have considered or intend to consider the significant effect that the fluid surrounding the constriction can have on the contact resistance, as evidenced by the first of the conclusions above.

With reference to Fig. 5 of ref. [1], it must be pointed out that, in practice, ε is usually of the order of 0.1 and, therefore, it is the comparison of resistances for values of ε less than about 0.2, that would be significant. In any case, for large values of ε, the constriction resistance would be small enough to be generally negligible. The authors correctly conclude that their work is in good agreement with that of Mikic [4] and, therefore, that of Yovanovich [5]. However, it is instructive to consider why the results of some of the other works do not agree. Fenech and Rohsenow [6], for example, consider average rather than the 'exact' boundary conditions. The solution of Williams [7] applies only to small values of the angle γ and, therefore, to large values of cot γ. (It may be noted, however, that the solution for small values of γ may be important in interpreting the results of tests performed on artificially contrived contact configurations such as crossed wedges.) These comments should help in understanding the differences observed between the results of various workers.

Finally, it is worth bringing the readers' attention to the fact that electrolytic tank analogue solutions, simulating conical constrictions in vacuum, are also available in ref. [8].

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