

SUMMARY

An experimental study of the sublimation of a solid into a fully-developed laminar air stream was conducted in a square duct. A square aluminum duct of 2 cm. inside width was used in this study. A naphthalene coating was applied on one side of the duct. To determine the effects of free convection, the test section was located on the bottom, top and side of the duct respectively.

Experimental test runs were performed at temperatures of 30°C and 50°C. A Reynolds number range of 200 to 900 was covered. The test section was an aluminum pan having dimensions 7.5 inches long by 0.75 inches wide by 0.125 inches deep. Volumetric flow rates of air ranging from 0.1 to 0.6 cubic feet per minute were used. Evaporation rates were determined from the test section weight loss. The final percentage saturation of the naphthalene in the air was calculated. The experimental results were compared with a theoretical relationship developed by Plewes and Butler [1954]. They predicted the final percentage saturation of subliming material in a viscous fluid to be proportional to the two-thirds power of binary diffusivity. The experimental results of the present investigation were generally in good agreement with the theoretical solution. It was found that the results of the lower temperature experimental runs agreed more closely than the higher temperature runs. The deviations are possibly caused by free convection effects resulting from density differences in the fluid near the subliming wall. For the conditions covered in this experiment, the final percentage saturation of subliming material in air was approximately 5 per cent different from the theoretical value at 30°C and 8 per cent different at 50°C.

The test section orientation, i.e., top, bottom, or side, had no significant effect on solid evaporation rates over the range tested.

SUBLIMATION INTO LAMINAR AIR
FLOWING IN A SQUARE DUCT

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CERTIFICATE OF APPROVAL OF THESIS


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