New Products

High Heat Transfer Thin Powder Sintered Heatpipe for Heatsink

1. INTRODUCTION

Recently, micro processing units (MPU) mounted on information terminal equipments, personal computers etc., continue to increase in density of electronic chips, in order to adapt multi-core application and integration of graphic and memory control functions. As a consequence, electronic chips generate more heat and increase heat density. On the other hand, from designing and portability aspects, not only high cooling performance but also further downsizing and thinner types are requested for mounted cooling devices, fan type heatsink etc..

To meet this technological trend, Furukawa Electric has developed and commercialized the new product of The Thin Powder Sintered Heatpipe. This product is a extra-high thermal conduction device and has a maximum heat transfer rate twice more than the maximum of the conventional company product heatpipe with thickness of 2 mm. Furukawa Electric has established the production system of 2 million sets of the new product heatpipe per month, out of total 5 million sets of the heatpipe production capacity, and has commercialized the thin type heatpine mounted with heatsink of high heat transfer rate.

2. FEATURES

In general, a vapor phase path, which transfers evaporated working fluid from heating section to cooling section as shown in Figure 1, is placed in the center of a heatpipe. Wick structures are set at the inner periphery of a container. Wick structures get capillary force to flow back working fluid, which is condensed at low temperature section, to heating section.

With this conventional structure, press flattening narrows the space for the vapor phase path of the heatpipe and the heat transfer rate is significantly reduced. Thinned wick structures ensure vapor phase path, but reduce heat transfer rate due to the reduction of the capillary force.

This new product heatpipe solves this problem by applying a special wick structure specialized for a flat shaped container. Figure 3 shows the structure. A semicircular shaped metallic powder sintered wick (a) is mounted on top and bottom of a flat container and these wicks make contact with each other in a sharp angle (b). This structure gives capillary force induced by surface tension of working fluid at the sharp angle contact part of the wick structure. At the same time the vapor phase path (c) with the equivalent space to conventional heatpipe is ensured at the right and left of inner periphery of the container, and the nonconventional high heat transfer thin heatpipe is achieved. Furthermore, by reducing the volume of the metallic powder sintered wick, the weight is reduced by 10% from the conventional heatpipe.

Figure 4 shows the maximum heat transfer ratio of the thin powder sintered heatpipe and the conventional heatpipe with $\phi 6$ mm diameter and 200 mm length of container. At 2 mm of thickness, the new product heatpipe has twice more heat transfer rate than the conventional powder sintered heatpipe.

Table 1 shows lineup of thin powder sintered heatpipe (dimension and approximate heat transfer rate).

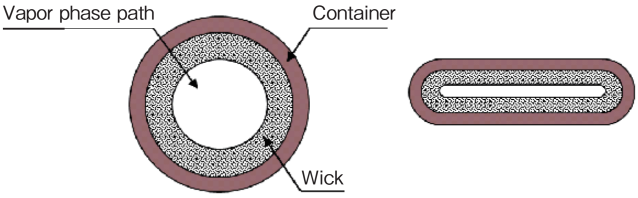

Figure 1 Conventional heatpipe structure and flattened shape.

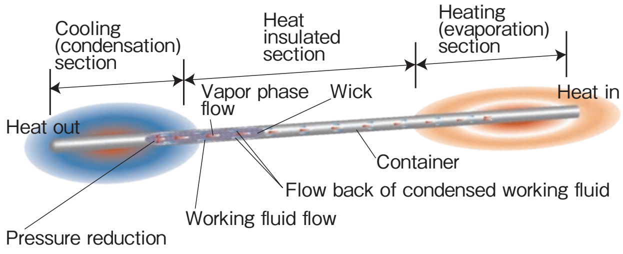

Figure 2 Heat transfer method of heatpipe.

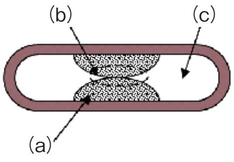

Figure 3 Structure of thin powder sintered heatpipe.

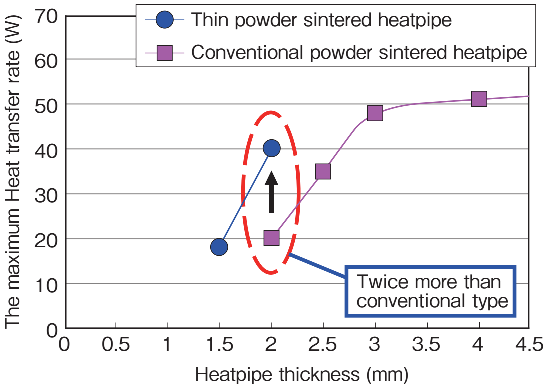

Figure 4 **Comparison of the maximum heat transfer rate.**

Figure 5 **Thin heatsink with heatpipe and fin. (Two heatpipes with thickness of 2 mm are used, for 50 W CPU.)**

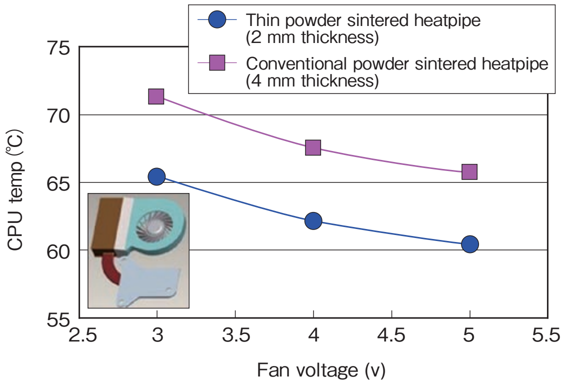

Figure 6 **Comparison of CPU temperature and fan voltage.**

3. APPLICATION TO HEATSINK

Furukawa Electric applies the new product heatpipe to heatsinks and commercializes it. Examples are shown in the followings.

3.1 Fin Heatsink For Notebook Computer

Thinned heatpipe gives additional merits to heatsink. Figure 5 shows thin heatsink with heatpipe and fin. Reduced heatpipe thickness is utilized as fin height and higher radiation efficiency is attained.

Figure 6 shows a relation between the fan input voltage and the computer processing unit (CPU) temperature (input 35 W, ambient temperature 25°C) on heatsink models: one is applied with thin powder sintered heatpipe (thickness 2 mm), the other is a conventional heatpipe (thickness 4 mm). Here, thin powder sintered model has 2 mm higher fin, than common model, utilizing thickness reduction. In this case, CPU temperature is significantly reduced by the increased fin radiation area, and by thermal resistance reduction effect between the CPU heat receiving plate and the heatpipe, caused by the increased heatpipe width. In addition, at the reduced fan voltage and its rotation speed, the heat radiation performance is equivalent to a heatsink mounted with conventional heatpipe, allowing for a design of fan with lower power consumption and lower fan noise.

3.2 Blade Server

Figure 7 shows a heatsink with a heatpipe for the blade type server. Typically, a plate type heatsink as represented by vapor chamber, has been mounted onto the heatsink for server. Parallel use of thin heatpipe gives equivalent heat radiation performance to conventional models, making the heatsink thin and affordable in price.

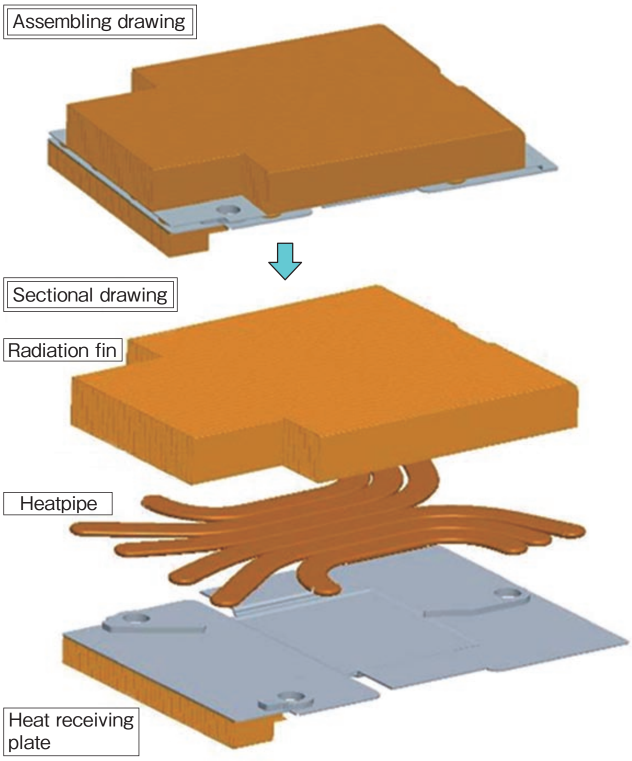

Figure 7 **Heatsink with heatpipe for the blade type sever. (Six heatpipes with thickness of 1.5 mm are used, for 140 W CPU.)**

4. IN CONCLUSION

The new product heatpipe with 2 mm thickness has twice as much heat transfer performance as conventional products, and contribute to a thinner design of cooling devices. At the same time, the new product contributes to energy saving, low noise etc. providing various cooling solutions that are environmentally responsible.

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