The micro channel heat exchanger with high pressure resistance and high efficiency

WELCON Inc.

The micro channel heat exchanger is a heat exchanger with channel of the micro-scale. (Several tens of μm to several hundreds of μm)

General heat exchangers have a channel with its diameter of several mm sizes and its length from several m to several tens of m. Therefore, its volume becomes large and heavy. There is a demand from the market for high efficiency.

Using micro channel technology is one of the techniques to achieve high efficiency and weight reduction.

Decreasing the channel diameter, it is possible to get high density of inner channels and increase the heat exchange area. Also, the distance between the fluids for heat exchange becomes closer, which makes it possible to take full advantage of the temperature gap between the fluids. With the channel diameter decreased, it is possible to reduce the influence of the temperature distribution of the fluid and perform efficient heat exchange.

For the commercialization of a micro channel heat exchanger, we've done two themes of R&D. The one is the diffusion bonding technology.

The diffusion bonding is a technology that uses diffusion of atoms to bond materials in an inert gas or in a vacuum, with pressurizing and heating at a temperature below the melting point. It can achieves precise bonding, suppresses deformation, and maintains the shape. This is how a micro channel heat exchanger with a precise channel is built. The brazing is another joining technology, but the diffusion bonding is a direct bonding, without using a brazing material. Therefore, when flushed with water, the corrosion caused by the battery effect of different materials does not occur. In addition, it can also be used at a high temperature of several hundred degrees. And there is no possibility that the melted brazing material blocks the fine channel. The area of diffusion bonded junction could obtain the strength of the base material. With appropriate design, it is possible to manufacture the heat exchanger which can be used under even several tens of MPa or higher pressure.

Another theme is to ravel a hydraulics phenomenon of a micro channel.

In collaboration with the laboratory of Professor Abe and Associate Professor Kaneko of the University of Tsukuba, we have done research on heat transfer and condensation of a micro channel. With that research, we have clarified the impact of a channel diameter, a flow path length and a number of stacked layers of a micro channel heat exchanger to its performance, and been able to optimize design. We are working on visualization of the evaporation and condensation behavior in a micro channel now.

By combining these technologies, it becomes possible to manufacture a heat exchanger which is compact but has an excellent performance with high pressure resistance, corrosion resistance, and high temperature resistance.

The micro channel has an excellent characteristic to be able to be used as a high performance heat sink for cooling the heat source. Therefore, we have developed various high-performance fluidic devices, applying the findings of micro channel heat exchangers studies.

Currently, leading research institutes perform the tests for application of the micro channel to the market. And actually they have been implemented to some semiconductor equipment.

Recently we have received many inquiries from various industries and applications are in progress to be released to the market, such as semiconductor, automotive, electrical, infrastructure, medical, waste-energy recovery, battery, and food process equipment.

Acknowledgment

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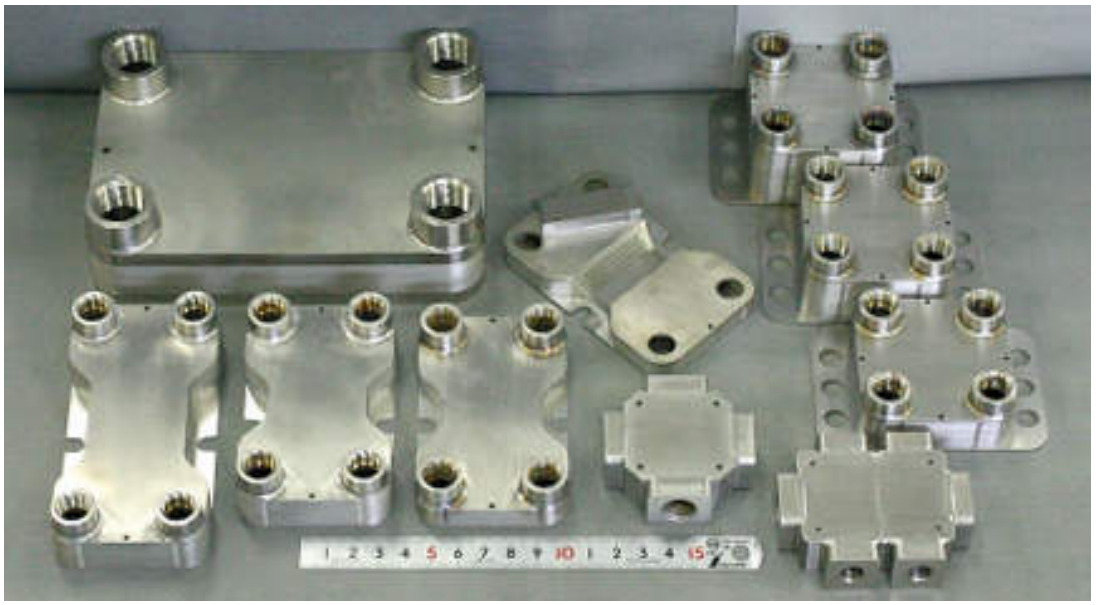

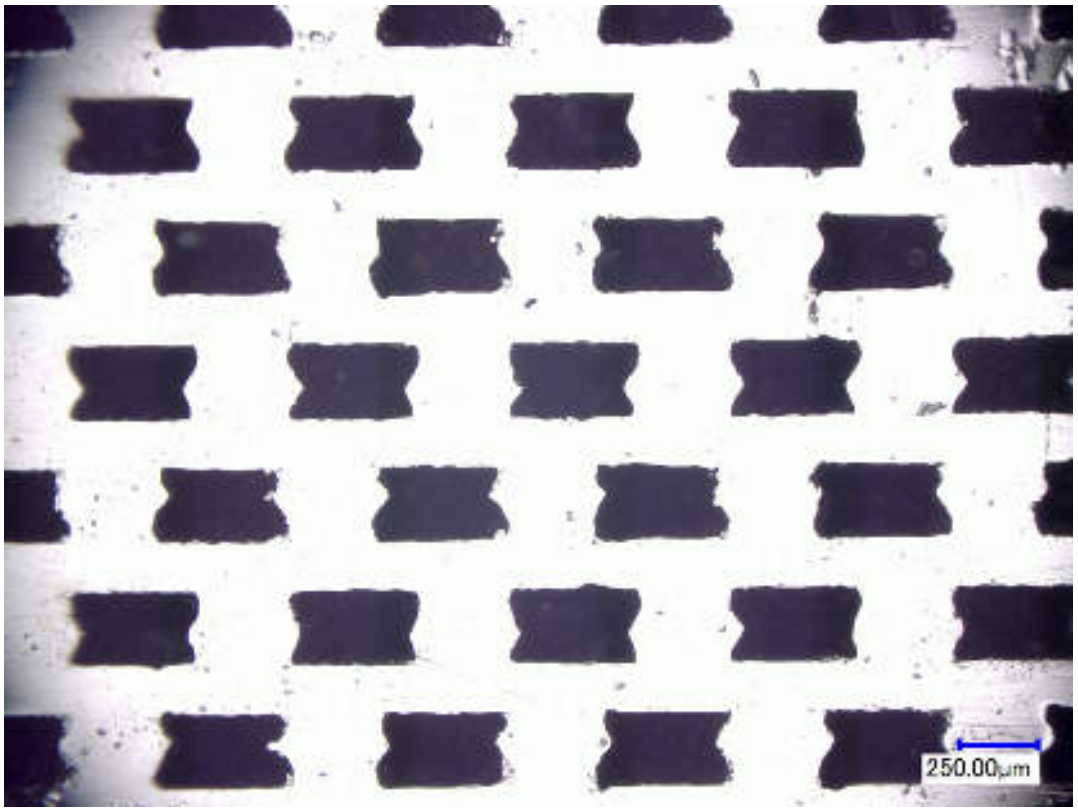
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