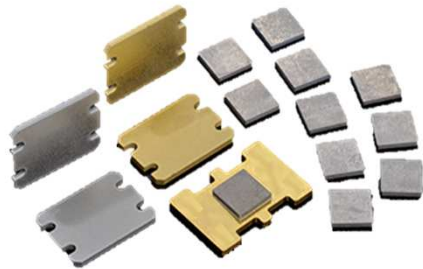




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Improving Reliability of Devices



Ag-Diamond Heatspreader for Power Devices

1. The reason thermal management is necessary for power devices.
2. The suitable heatspreader for the application.
3. Summary & a little introduction about us.

Apr, 2021

Heat Spreader Division

A.L.M.T. Corp.

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The reason thermal management is necessary for power devices

As power devices get more and more advanced, ...

they generate excess heat and thus require thermal management to improve its reliability and prevent premature failure.

For that, one of the cooling solution is to use “heatspreader”



The suitable heatspreader for the application

Ag-Diamond (AD90)

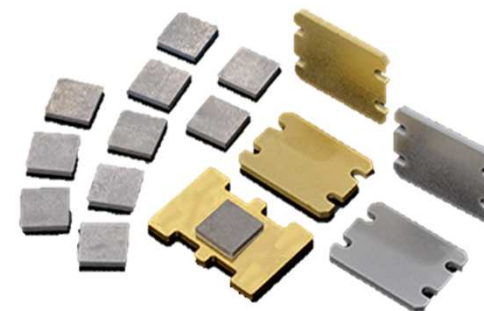
- High and Stable Thermal Conductivity! $> 600\text{W}/(\text{m}\cdot\text{K})$
- Available with Ni and Ni/Au plating
- Suitable for Ag-Brazing (780°C)



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Properties (Typical)

Thermal Conductivity (TC)		>600 W/(m•K)
Coefficient of thermal Expansion (CTE)	RT~400℃	9.0 ppm/K
	RT~800℃	10.5 ppm/K
TC (after heat-treatment at 800℃)		No change
Specific Gravity		5.9
Specific Heat		0.34 kJ/(kg•K)
Young's Modulus		346 GPa
Poisson's Ratio		0.24



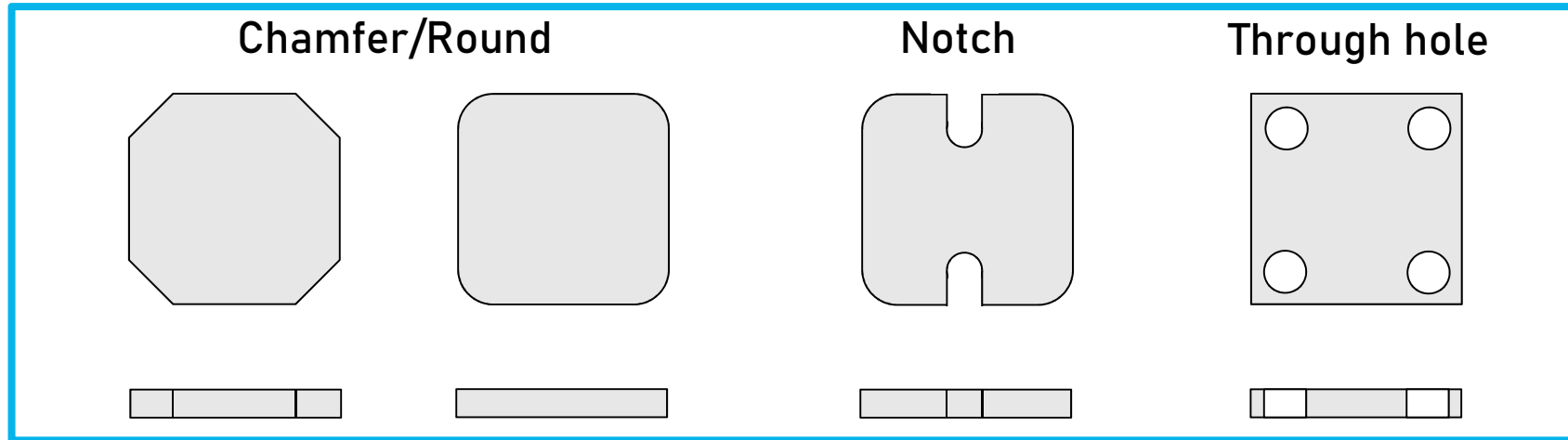
Design Guide

Thickness (mm)	Dimension (mm)	Surface Roughness	General Tolerance (mm)	Sharp Edge	Plating
0.2~5.0	50 sq. max	Ra 1.0μm	+/- 0.05	N/A (Under development)	• Ni • Ni/Au

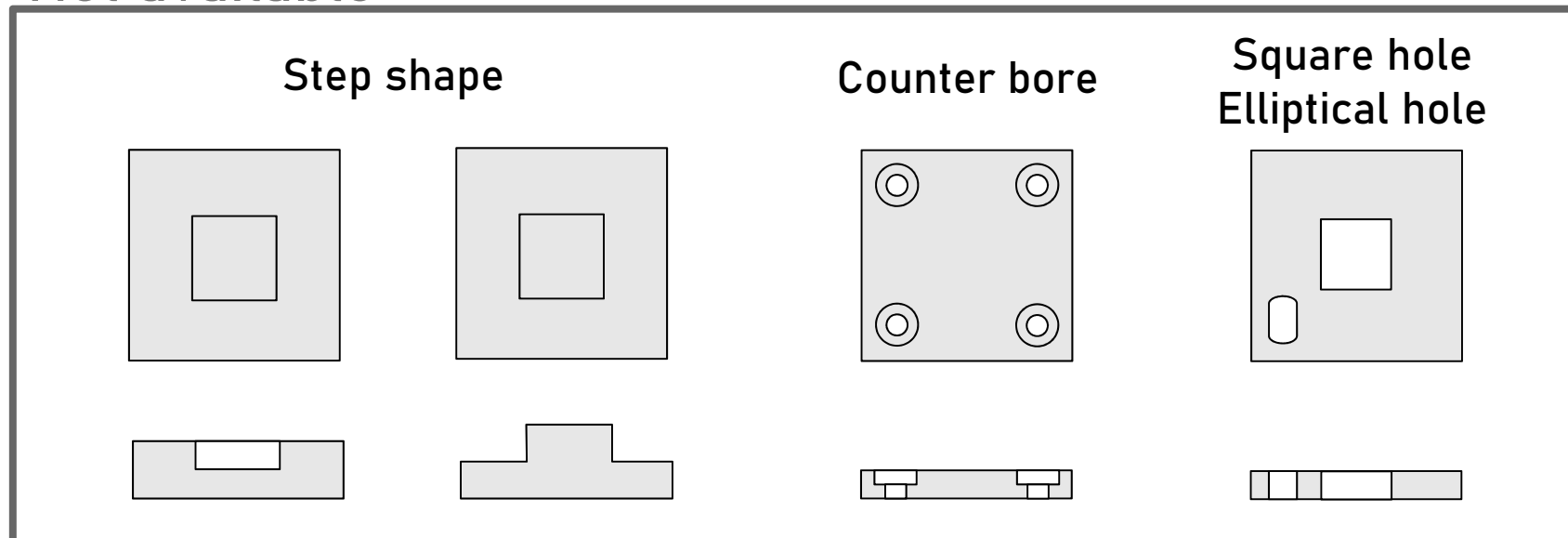


Product shape

Available

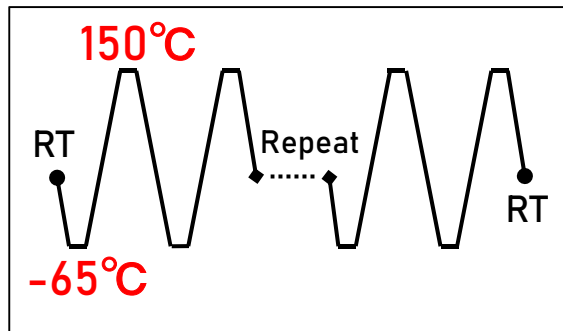


Not available

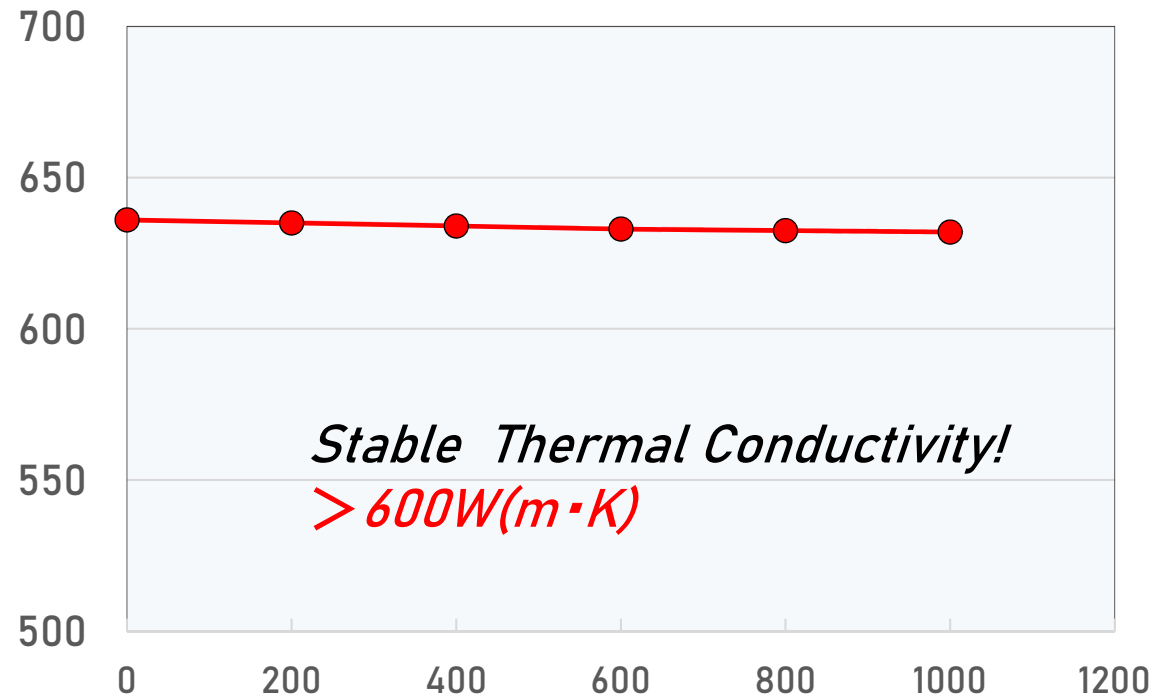


High Reliability

Decreasing of Thermal Conductivity



Heat cycles condition
(Liquid bath)



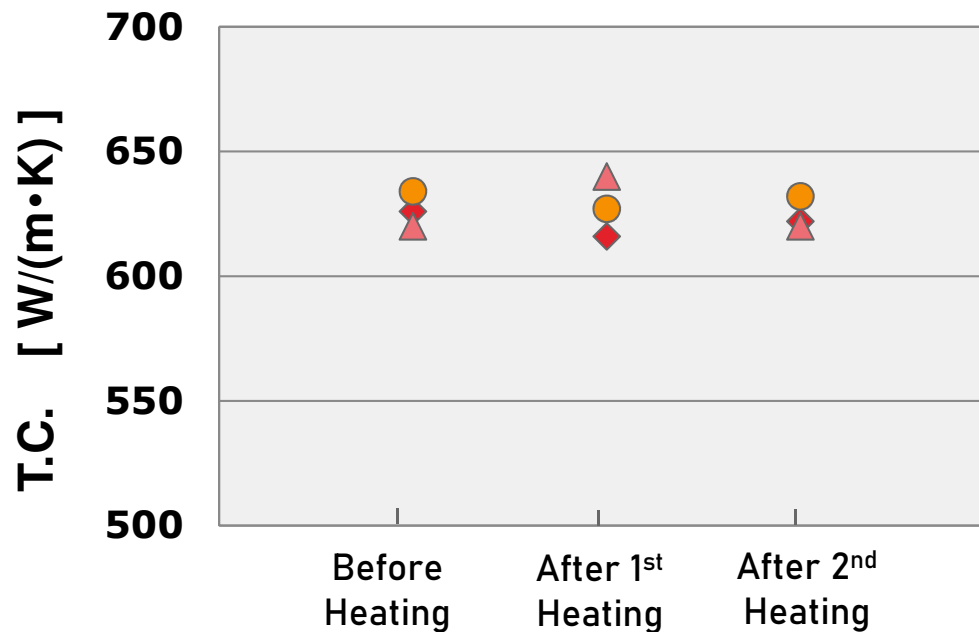
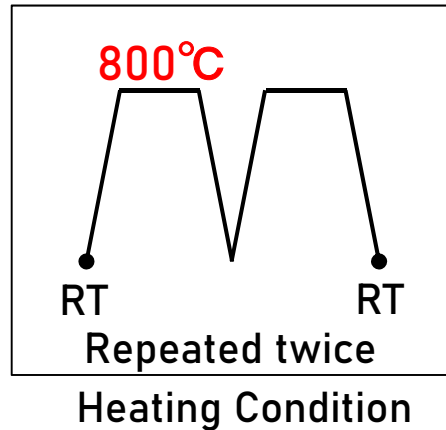
Ag-Diamond keeps over T.C. $600\text{ W}/(\text{m}\cdot\text{K})$
even after heat-cycles test.



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Ag Brazing Assembly

Influence of Heat Treatment (800°C)



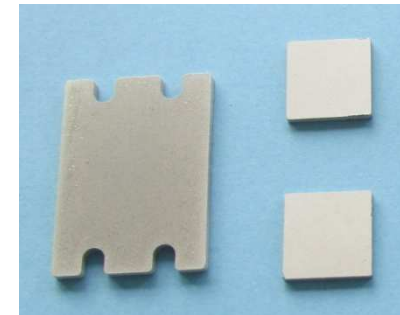
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Assembly of Ceramics Package

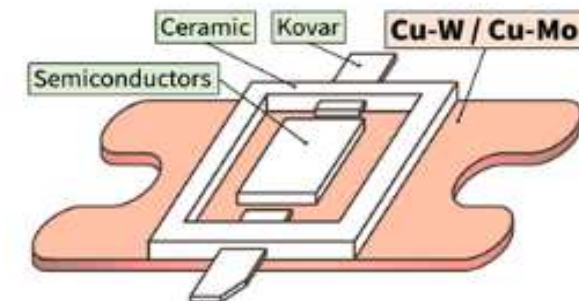
Ag-Diamond base plate



+ Ceramics Lead

Ag Brazing (780°C)

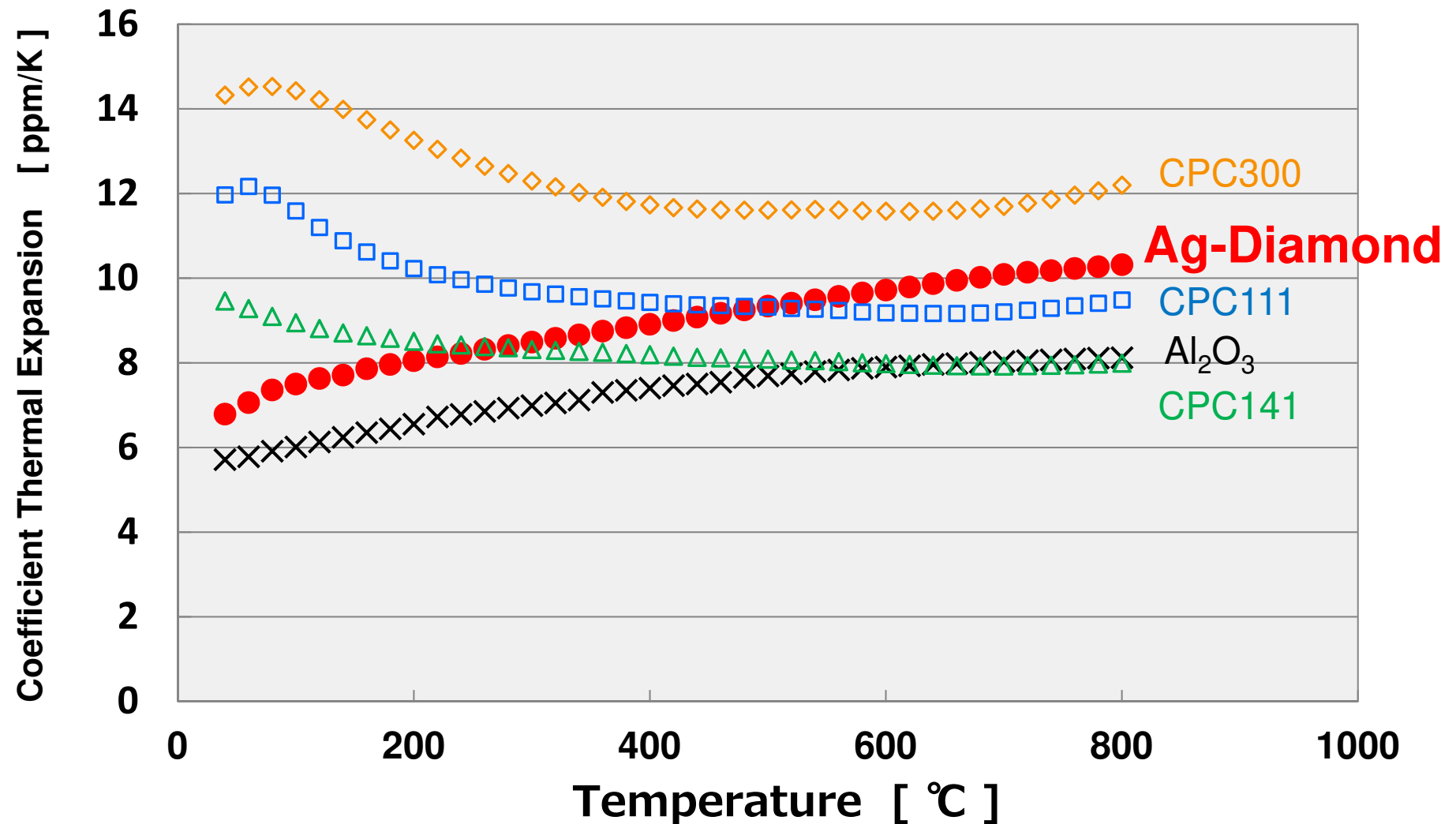
Ni/Au plating



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Temperature Dependence of C.T.E.



CPC ... A composite material (copper, copper-molybdenum, copper)



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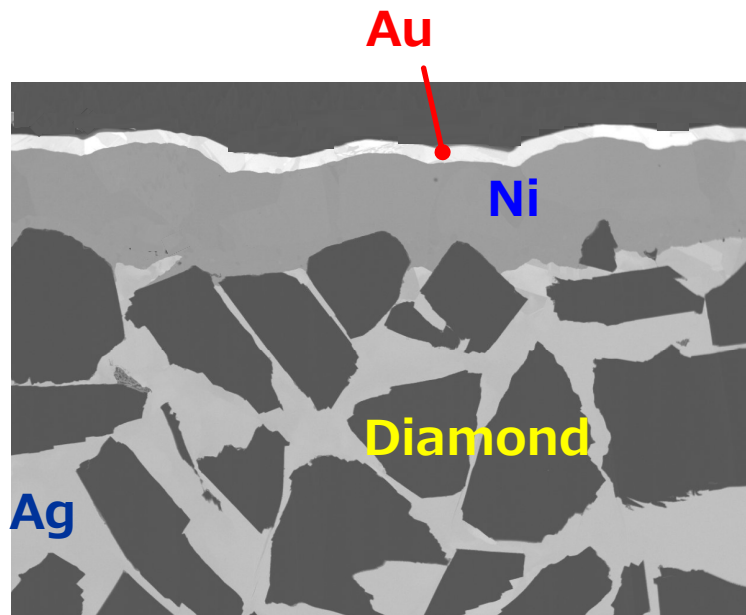
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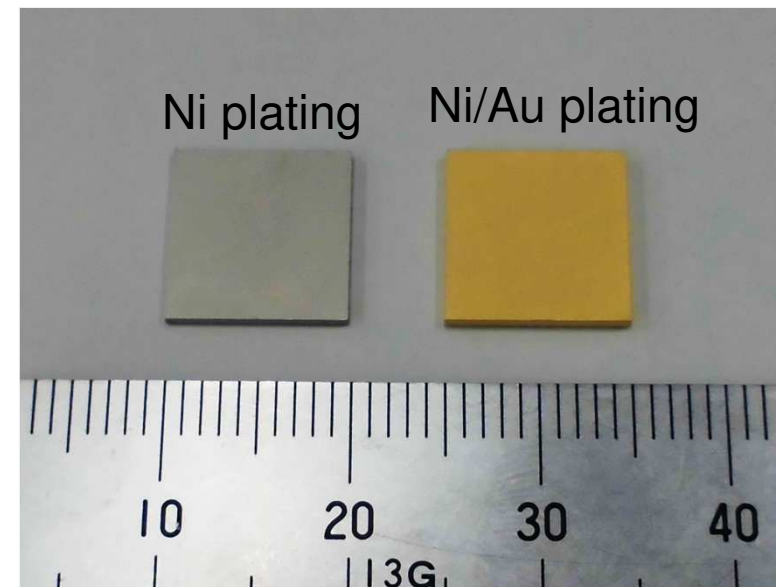
Plating

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1. Cross section after Ni/Au plating



2. Appearance after heat treatment



**No blisters at 800°C (Ni)
and 400°C (Ni/Au)**



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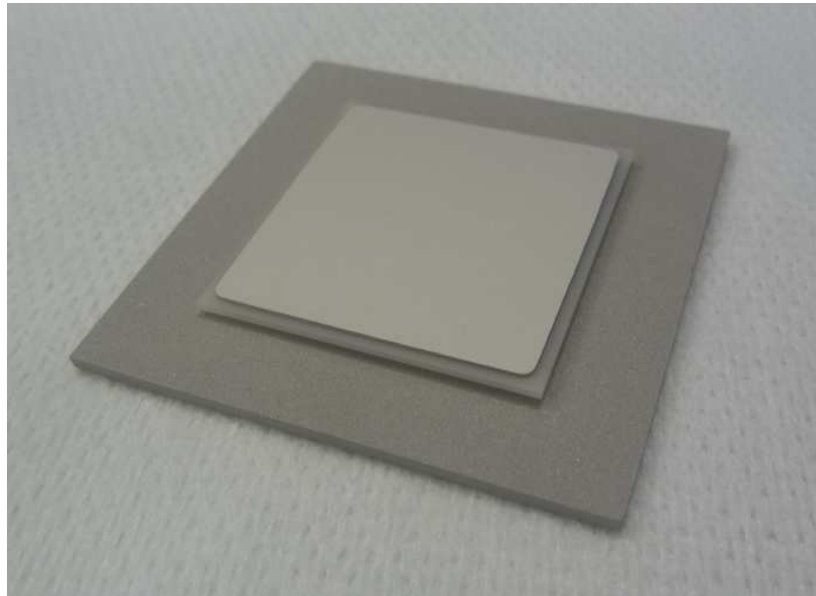
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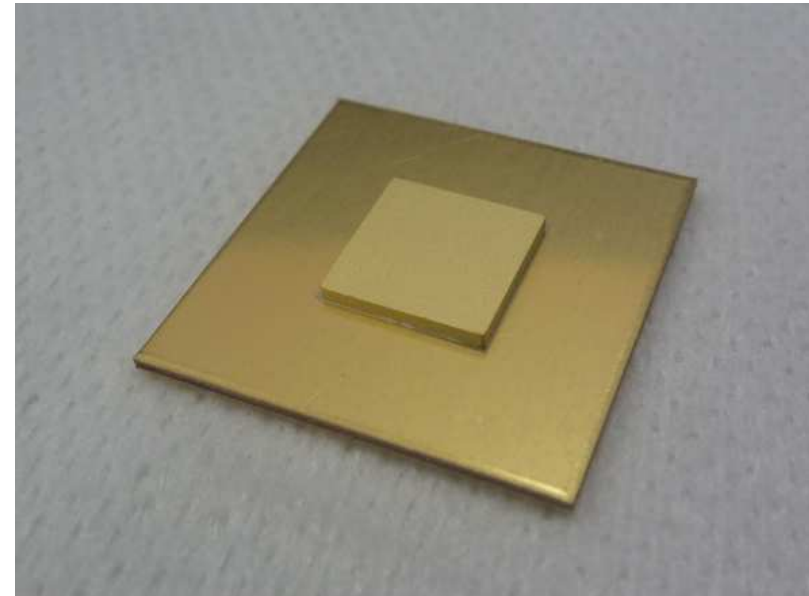
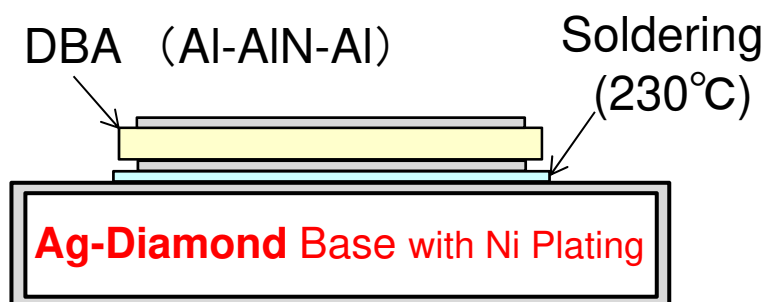
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Assembled Samples



<Cross Section>



<Cross Section>



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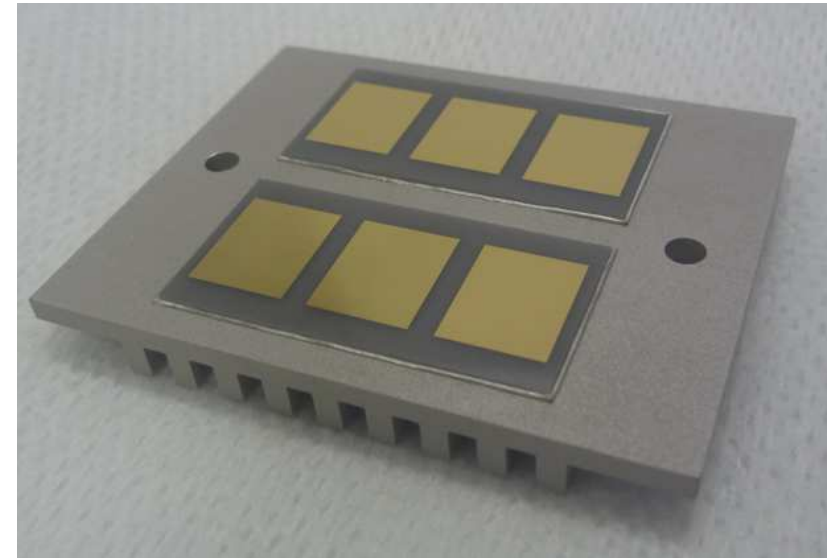
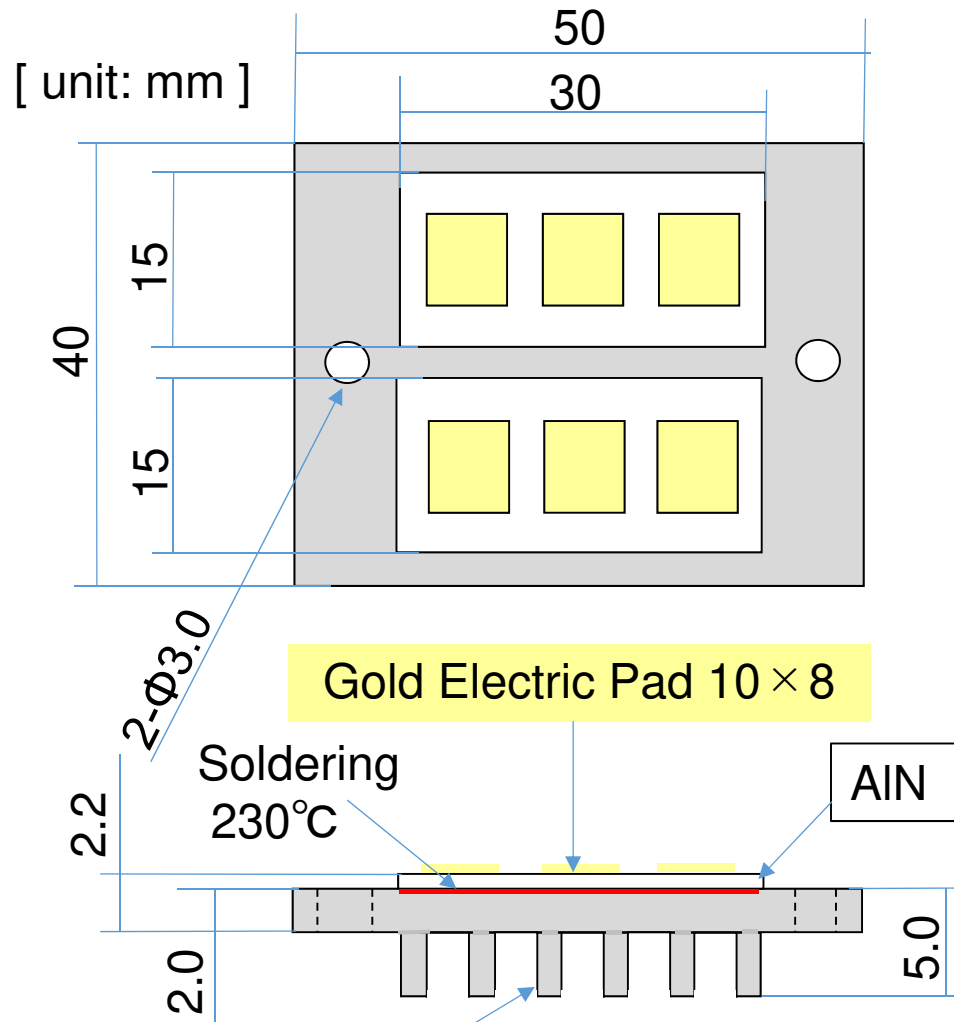
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Sample for Power device (for Automobile)



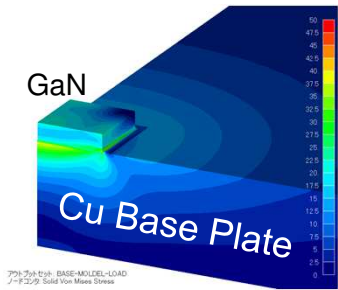
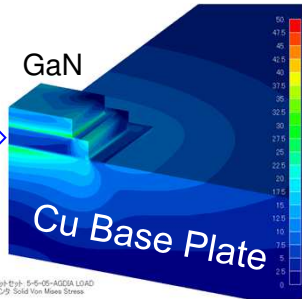
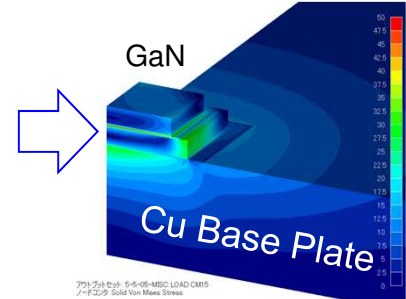
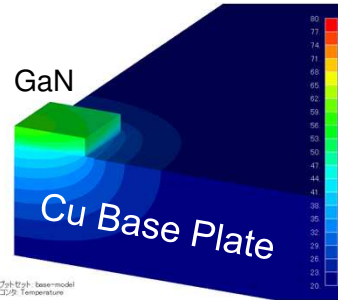
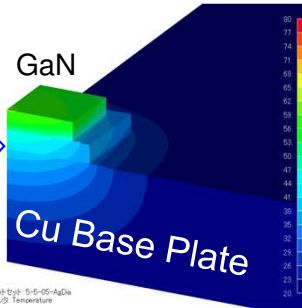
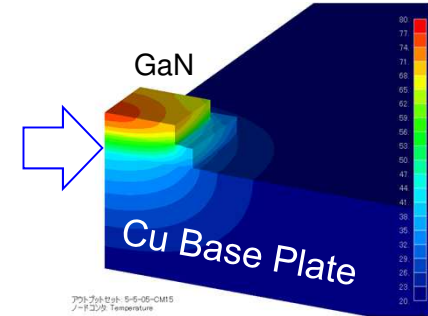
Fin Shape Ag-Diamond with Ni Plating
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Comparison of Thermal Stress and Temperature on GaN chip

	Cu Base Model (No Chip Carrier)	With <u>Ag-Diamond</u> Chip Carrier	With <u>Cu-Mo</u> Chip Carrier
Thermal Stress of GaN Chip	39.0 MPa  GaN Cu Base Plate アノリ・チップ・モデル: BASE-MODEL-LOAD ノード・スタック: Solid Von Mises Stress	30.7 MPa  GaN Cu Base Plate アノリ・チップ・モデル: S-6-05-AGDA-LOAD ノード・スタック: Solid Von Mises Stress	31.8 MPa  GaN Cu Base Plate アノリ・チップ・モデル: S-6-05-CMIS-LOAD-CMIS ノード・スタック: Solid Von Mises Stress
Temperature on GaN chip	57.7 °C  GaN Cu Base Plate アノリ・チップ・モデル: base-model ノード・スタック: Temperature	59.1 °C  GaN Cu Base Plate アノリ・チップ・モデル: S-6-05-AGDA ノード・スタック: Temperature	75.5 °C  GaN Cu Base Plate アノリ・チップ・モデル: S-6-05-CMIS ノード・スタック: Temperature



Summary

- As power devices are getting more developed, thermal management is coming to be more important.
 - Ag-Diamond is suitable material for the application with the following features.
 - ✓ TC is more than $600\text{W}/(\text{m}\cdot\text{K})$
 - ✓ Stable TC after heat-cycle
 - ✓ Ni and Ni/Au plating are available
 - ✓ Ag-Brazing (780°C) is available
 - The heatspreader will be able to assembled with isolated plate and/or popular metals.
- Using a Ag-Diamond, "super heatspreader", your device can now reach even greater potential, and truly achieve the highest level of performance!

For more detailed information or technical data, please visit our page on DPC2021 website!



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For our Homepage

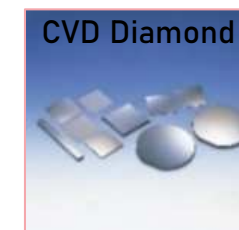
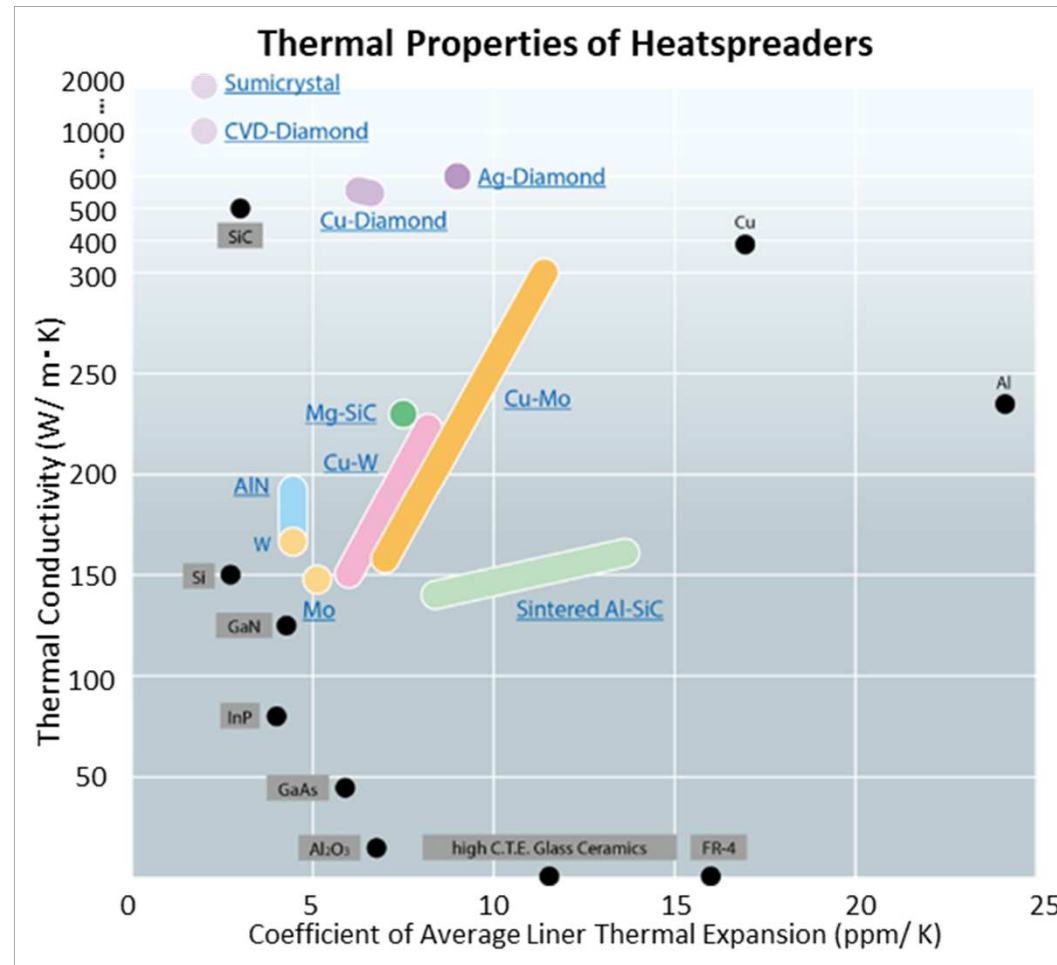


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A little introduction about us

In addition to Ag-Diamond, we are manufacturing many kinds of heatspreaders for various fields.



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<https://www.allied-material.co.jp/english/>



Thank you !

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