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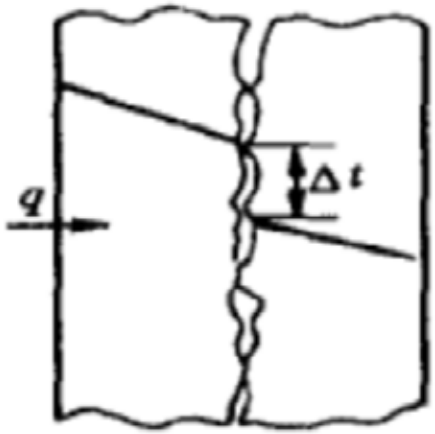
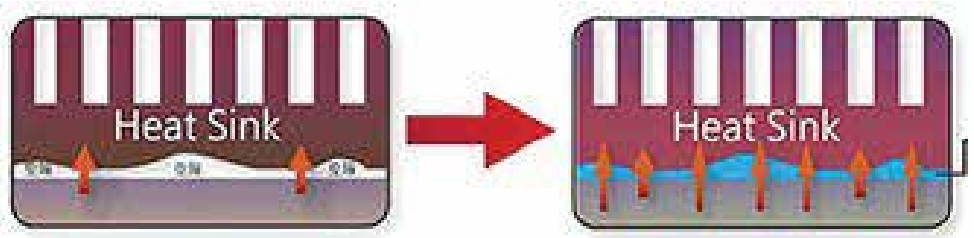
01
Product Overview

1.1 Definition

Thermal Interface Material is used for filling between two materials.It is an important bridge for heat transfer to fill the gap and improve heat transfer efficiency and low thermal impedance. It is often called a thermal conductive material.



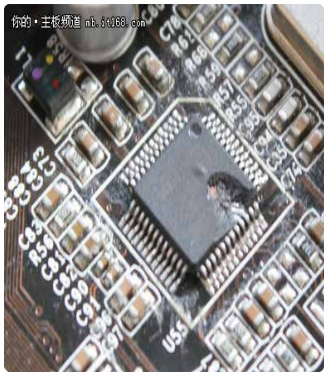
nominal contact between two interfaces



From point contact to surface contact

Why heat dissipation is necessary?

Statistical data show that the reliability of electronic components decreases by 10% with each increase of 2 degrees Celsius, and the lifetime of electronic components at 50 degrees Celsius is only one sixth of that at 25 degrees Celsius.

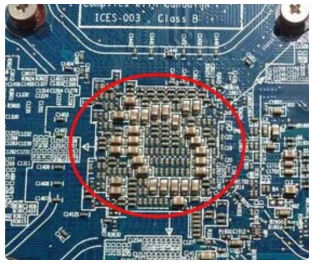


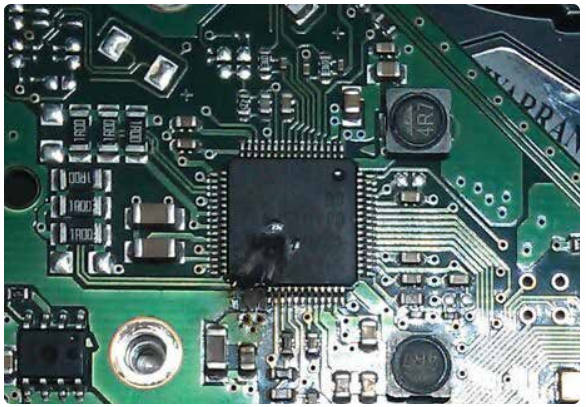
The adverse effect of excess heat :

1, Affecting the stability of the adjacent parts

2, Resulting in an unstable safety hazard

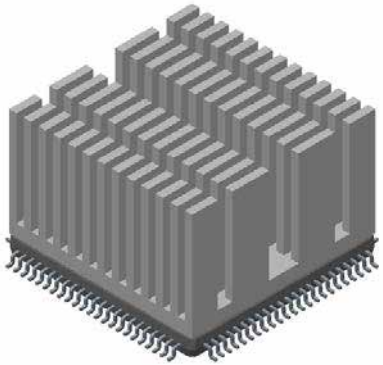
3, Reducing the service life.



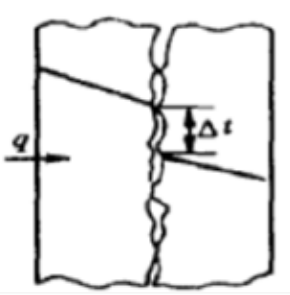


Why thermal interface materials is necessary?

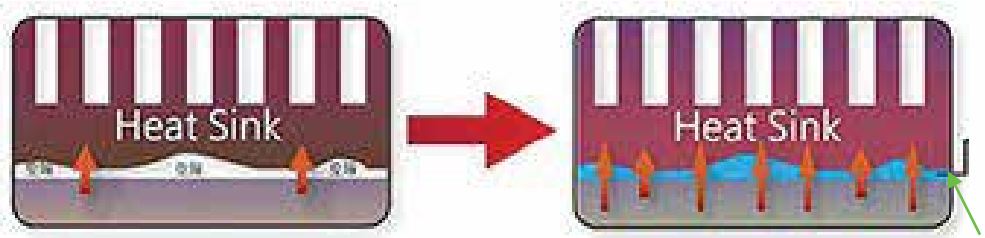
Contact gap



Ideal contact effect



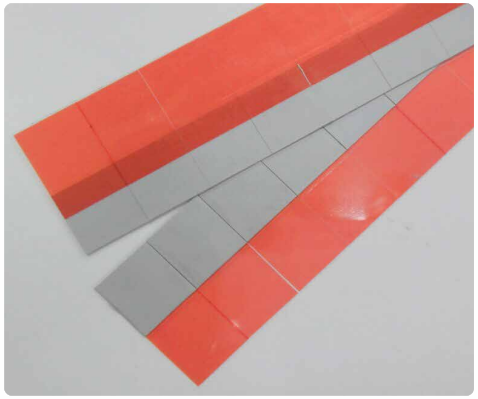
There is a gap in the contact interface under enlargement.



Transferring point contact into surface contact, and increasing of heat channel.

Dielectric material

1.2 Common thermal interface materials



•Types:

1，Thermal pad

2，Thermal phase-change material

3，Thermal gel

4，Thermal grease

5，Solid cryogel

6，.....

1.2 Common thermal interface materials

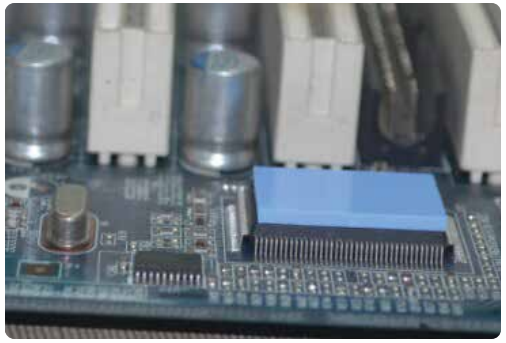
- **Thermal pad :**

➢ Wide range of thermal conductivity silicon, non -silicon material

➢ Easy to operate, low cost, and can be made of various shapes

➢ Product's thickness below 1m can be made into a roll shape,

➢ Being soft, with good compressibility



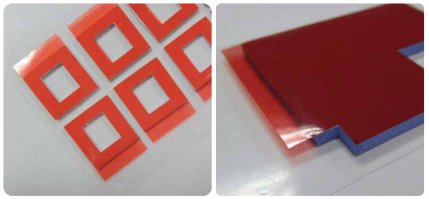
- **Application scenario:**

• The large contact gap between the chip and the heat dissipation module and the gap needs to be compressed.

- **Typical applications:**

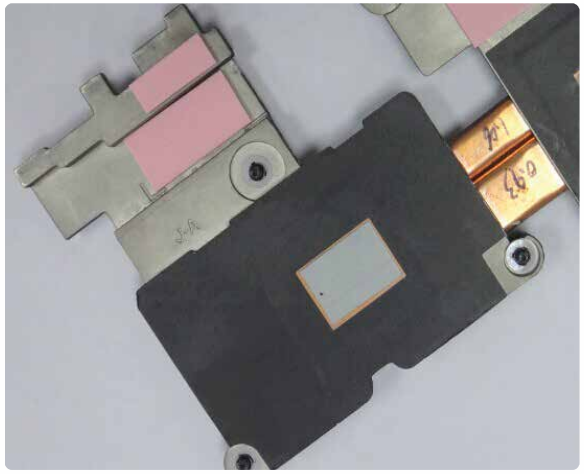
• Optoelectronics industry, Netcom products, new energy batteries,

• Automotive industry, household appliances industry, wearable devices



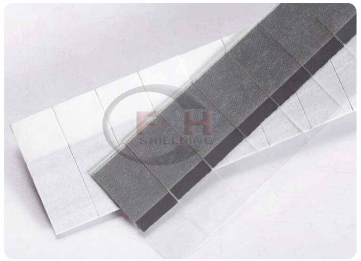
1.2 Common thermal interface materials

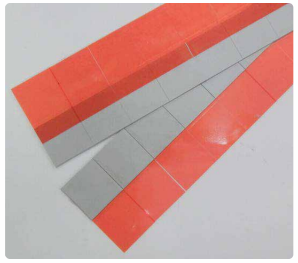
- **Thermal phase-change material:**
  - ✓ Extremely low heat resistance, high efficiency of heat dissipation
  - ✓ Excellent heat transfer performance and easy to apply.
  - ✓ It has hot filling performance, small gap can also be filled
  - ✓ Good operability and similar to ordinary silicon gel.



- **Application scenario:**

  Places needing change its physical state within a certain range of temperature





- **Typical applications:**

  The computer industry, the integrated circuit market,the mobile phone industry, the network communication equipment, the automotive electronics, and the aerospace aviation

1.2 Common thermal interface materials

Thermal grease

- Characteristics:

✓ high thermal conductivity, low heat resistance

✓ Small Young's modulus, small stress

✓ No silicon oil, no pollution,

✓ Easy to operate ,shape, and heat curing.

- **Application scenario:**

✓ Suitable for high and low interfaces

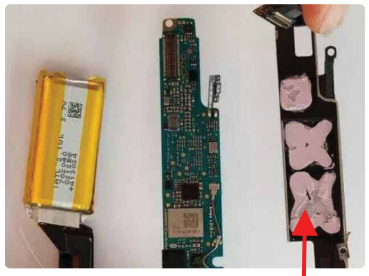
✓ Multiple chips share a radiator.

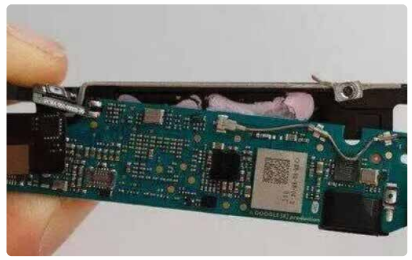
- **Typical applications**:

✓High performance CPU and display card processor,

✓Mobile phone motherboard,

✓Wearable device





Thermal grease

1.2 Common thermal interface materials

Thermal silicone grease :

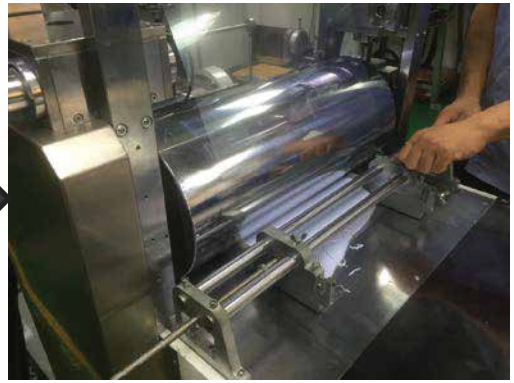
- ✓ High K value and high thermal conductivity, fast heat,
- ✓ Application in wide range of temperature, good chemical stability, no corrosion,
- ✓ Nano gap filling effect
- ● **Application scenario:**
- ✓ Uitable for high heat flux requirements
- ● **Typical applications:**
- ✓ Chip packaging, CPU/GPU heat dissipation linker
- ✓ LED lamp semiconductor bulb packing base

1.3 Production process of thermal conductive silicone pad

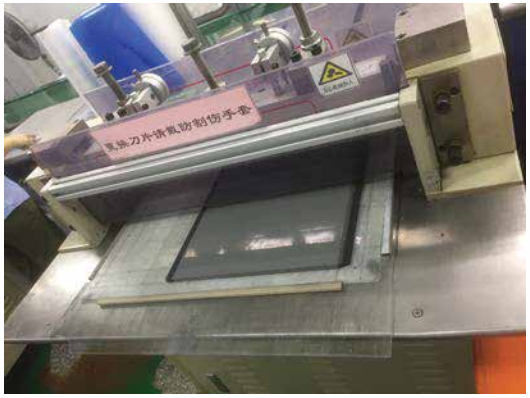


Raw Material

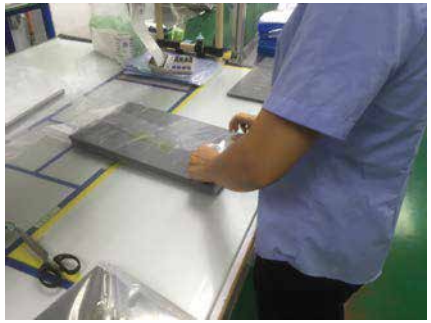
Mixing



Calendering



Die-cutting



Packing

inspection

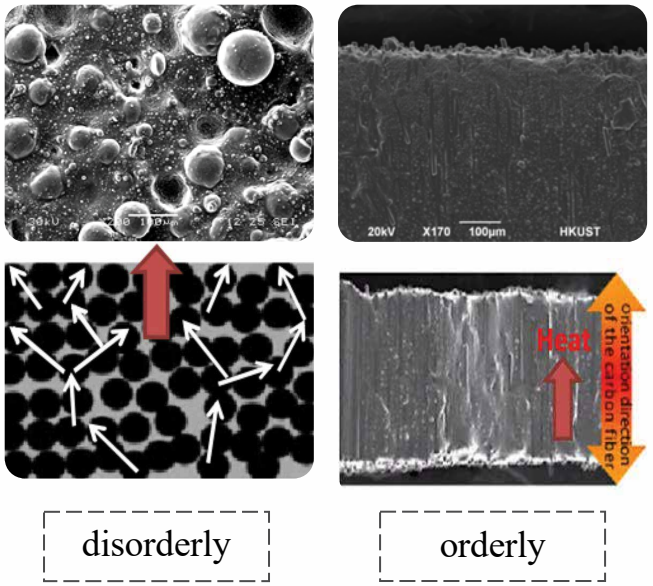
A new type of thermal interface material to cope with high heat flux density

————Orientation conductive gasket

In order to improve the thermal conductivity and reduce the thermal resistance, other mechanical and physical properties of the gasket are required for the new thermal interface materials with high thermal flow density.

- Traditional spacer VS new orientation gasket

characteristic	traditional gasket	high orientation gasket product
filled material	ceramic powder	high direction material
hardness	≥Shore 00 50°	< Shore 00 30°
compressibility	≤ 30%	60%
strength	<0.1 M pa	0.3 M pa
density	3.0 g/cm³	1.5 g/cm³
thermal resistance	0.3 ℃ . in² / W	<0.1 ℃ . in² / W



- the thinnest acan reach to 0.3mm@20W/mk and heat resistance to 0.05 C.In2/W

A new type of thermal interface material for high thermal flow density----solid-solid phase change material

A kind of energy storage material, which can be stored and energy released through solid phase transformation of the material. In the process of phase transition, there is no characteristics of liquid or gas generation and absorption

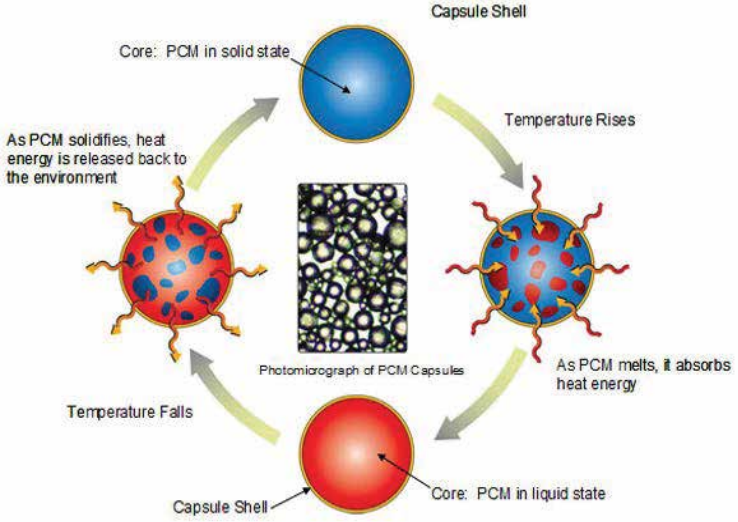
Characteristics of applied material:

1, High phase transition enthalpy

2, Appropriate phase transition temperature

3, The finished product has certain elasticity and compressibility

4, Thin

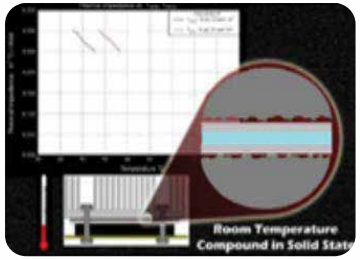


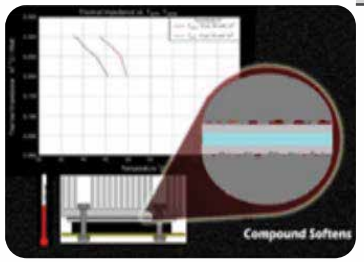
Phase change microcapsule principle

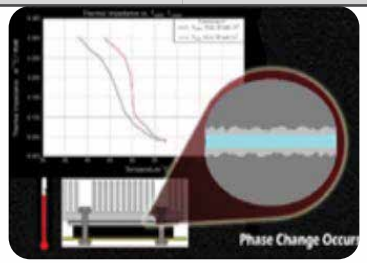
- **A new type of thermal interface material to cope with high heat flux density———— The low-temperature metal.It is an solid liquid phase change material. High thermal conduction and high infiltration after phase change bring it an ultra low heat resistance**
- Silicon grease VS low temperature metal

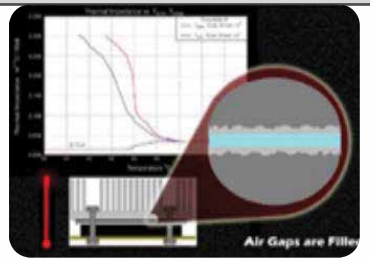
Low temperature metal:
Minimum thermal resistance can reach to 0.01in2℃/W
equivalent to 100 power of 1 square inche
the temperature difference is less than 1 ℃

properties	tradition	liquid metal
filling material	polymer / powder filling,	cryogenic alloy
thermal resistance	＜220℃	500℃
the flow characteristic	colloid flow	the formation in normal temperature
drying time	1 year	0
thermal resistance	0.1 ℃ . in² / W	＜0.02 ℃ . in² / W







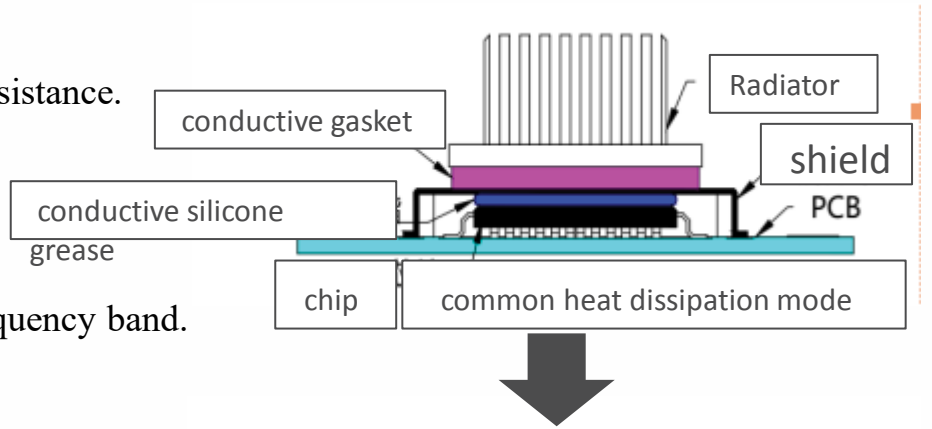


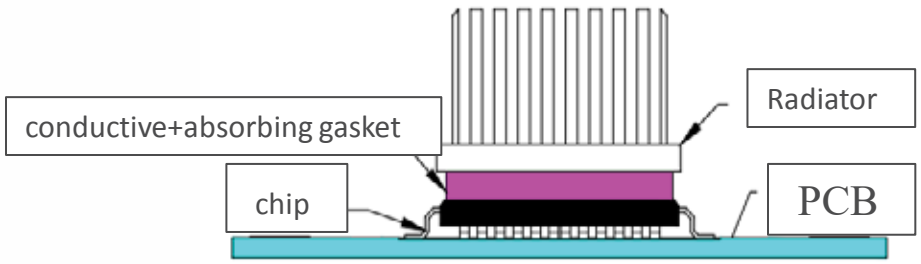
contact gap (cold) → **gradual melting (phase change)** → **infiltration ,** → **low thermal resistance and thermal conduction**

New thermal interface materials with high thermal flow density———— Thermal conductive and absorbing composite gasket

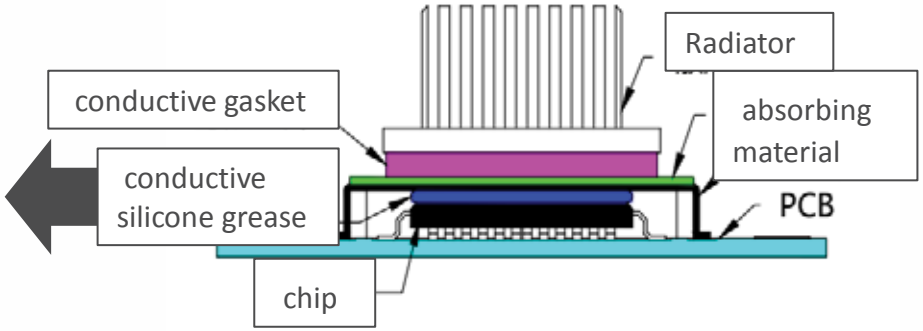
It can suppress the unneeded energy coupling, resonance and the electromagnetic interference of the circuit board level caused by the surface current, and also have the thermal conductivity

- 1. With high heat conduction and lower heat resistance.
- 2.Good softness and compressibility.
- 3. A certain magnetic permeability.
- 4.With the absorption characteristics of the frequency band.





Ideal mode



radiation interference mode to chip

02

Product Test

2.1The performance evaluation and test of thermal interface materials

Thermal conductivity: （W/mk）,
Under the same conditions, the higher thermal conductivity, and the better the thermal conduction ability.

Typical test

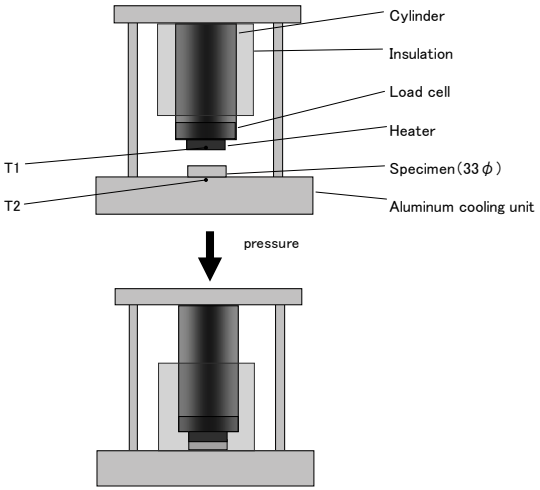
Long-win 9389

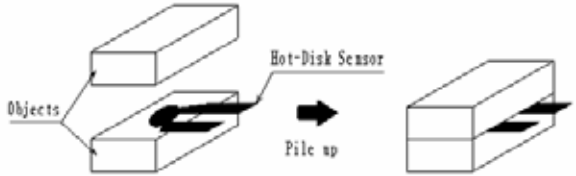
TPS-2500S

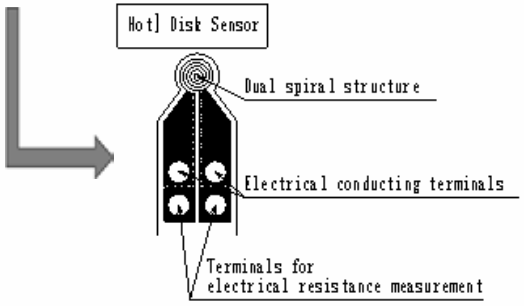
ISO-22007-2

Test principle

ASTM-D5470







2.2 The performance evaluation and test of thermal interface materials

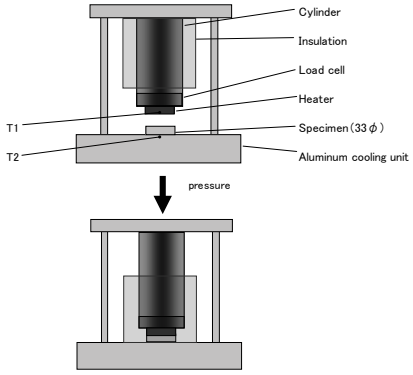
Thermal resistance: the resistance of thermal conduction

DRL-III thermal resistance tester

Heat dissipation simulation system

Test principle

ASTM-D5470



$$R=(T1-T2)\times S/Q$$

R: thermal resistance (℃·cm^2/W)
T1: heater temperature (℃)
T2:heat sink plate temperature (℃)
Q:applied electric power (W)
S:area of compressed sample (cm^2)

2.3 The performance evaluation and test of thermal interface materials

Hardness: the ability of materials to resist the entry of hard objects into the surface

Shore C
Hardnes Tester

Shore 00
Hardnes Tester

Dielectric strength: the ability of materials to resist external voltage(KV/mm)

2.4 The performance evaluation and test of thermal interface materials

Mechanical properties: tensile strength, elongation at break, Young's modulus and stress strain

Material universal testing machine

Mensile test

Mompression tester