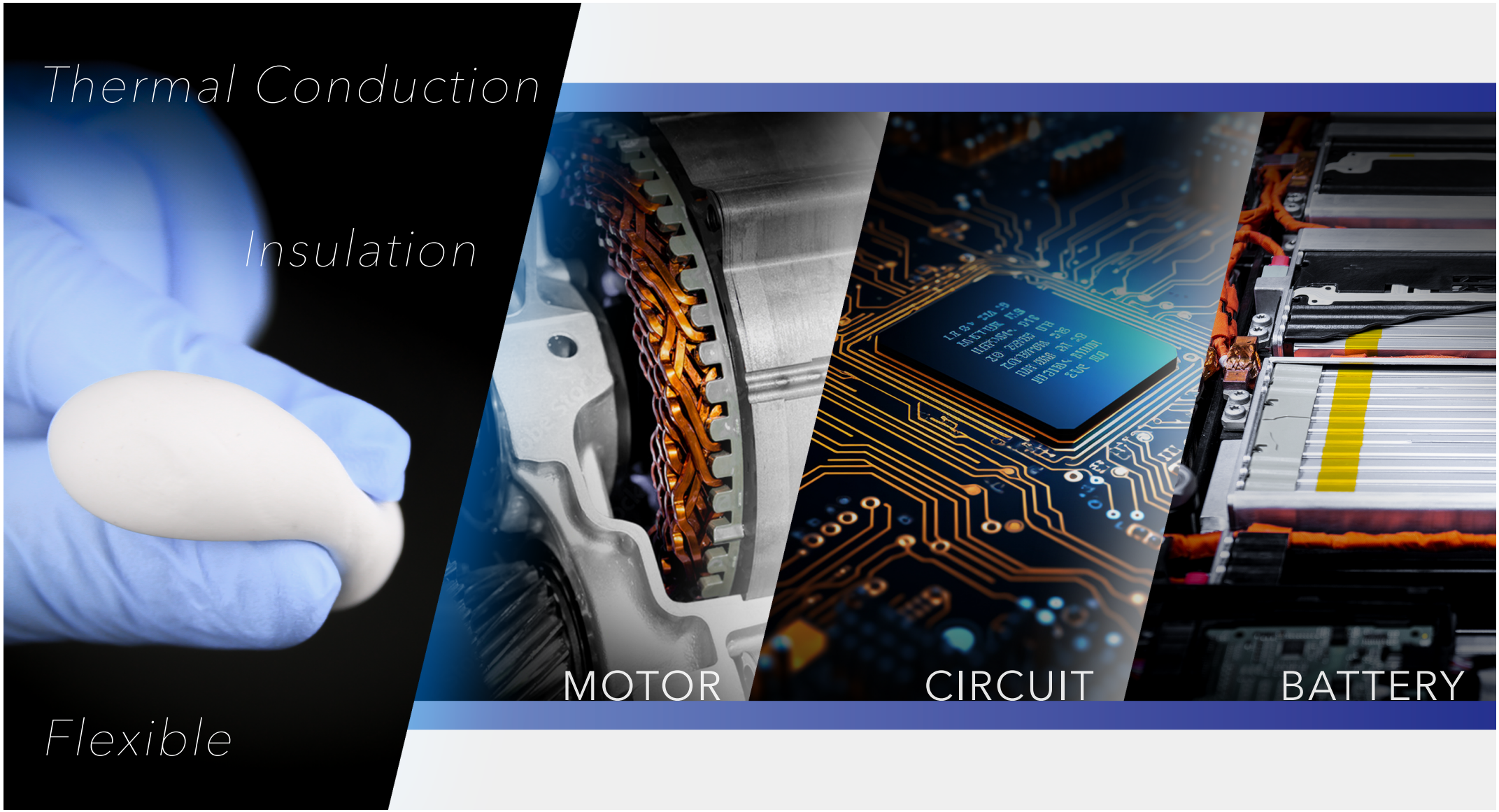


High thermal conduction insulation that conforms to complex uneven spaces

Clay-like thermally conductive material

Att. No.389E・03-2025

Trends in the heat dissipation materials market

1. Market size trending upward

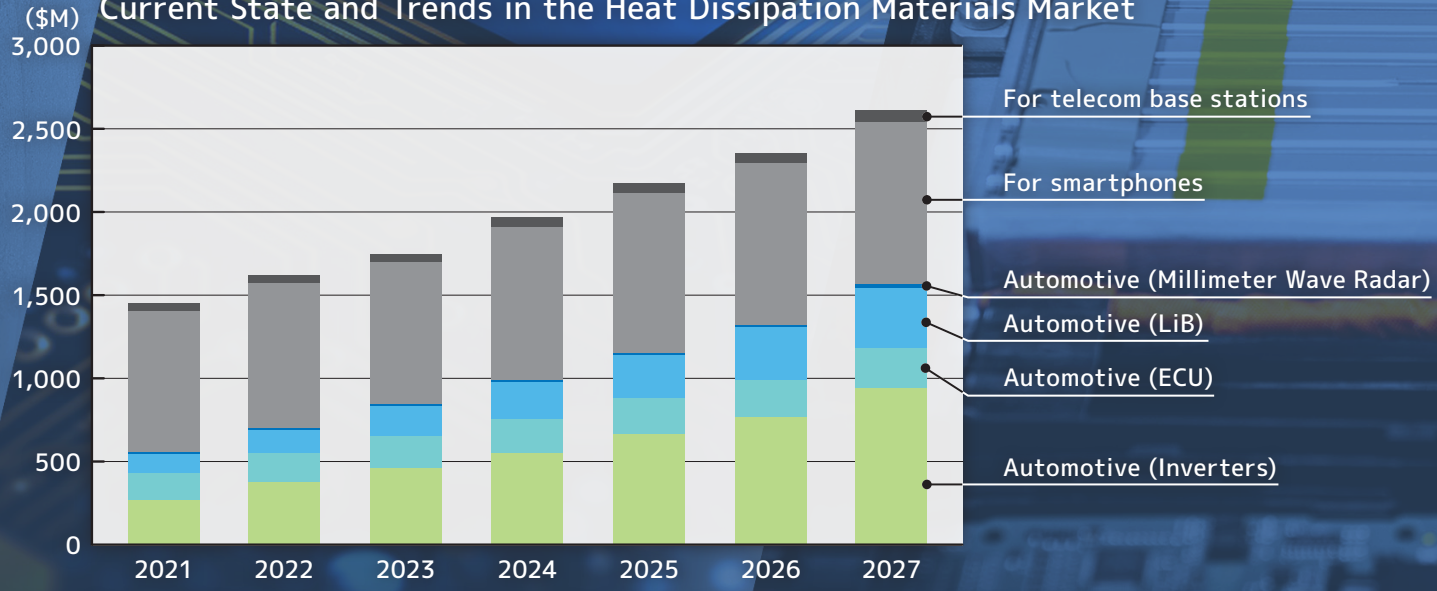
・Global market to grow to 1.5 times current size from 2022 to 2027

・The market for units for EVs will grow in particular

2. Heating values will increase due to higher unit output and density

・Trend toward higher thermal conductivity for thermally conductive materials

Current State and Trends in the Heat Dissipation Materials Market



Source: Fuji Keizai Group, "2023 Thermal Control and Heat Dissipation Materials Market Status and New Application Development" (July 2023)

There is demand for materials that can overcome the weak points of conventional thermally conductive materials

Comparison of typical thermally conductive material characteristics

Characteristic	Sheet	Grease	Gap filler	NOK Clay type
Adhesion to uneven surfaces, gaps	×	△	◎	◎
Pump-out, bleed-out	◎	△	○	◎
Stress on mating surface	△	○	○	○
Temperature change and vibration followability	◎	×	○	○
Storage stability	○	○	△	○
Auto-application	×	◎	◎	○

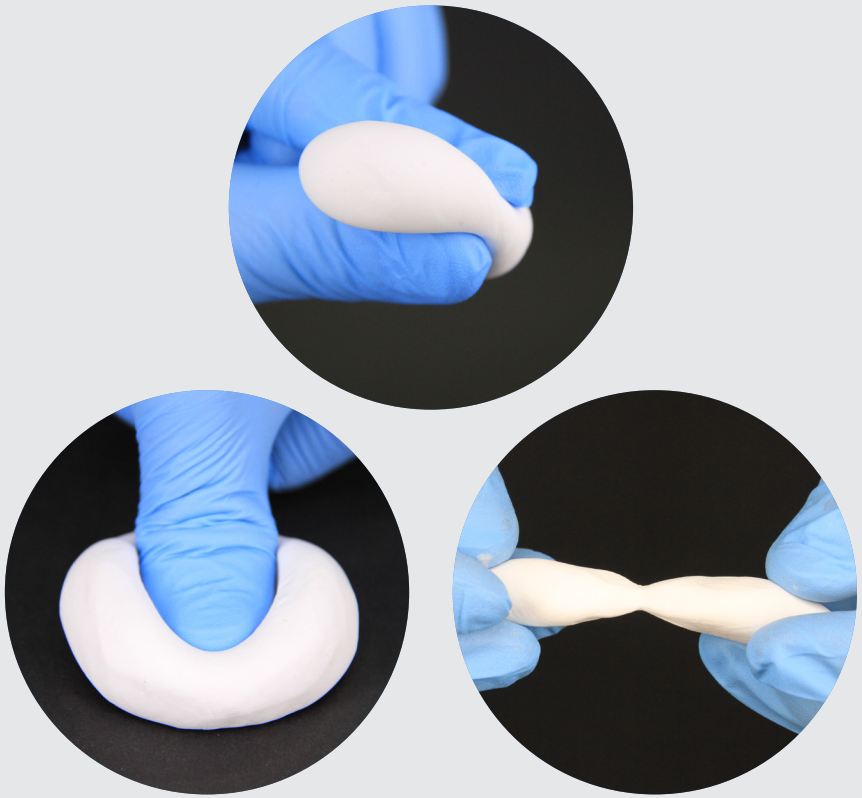
Clay-like thermally conductive material…

- Needs no curing reaction-easy handling
- Adheres easily to uneven surfaces and gaps
- Is pump-out and bleed-out resistant
- Puts less stress on mating surfaces
- Can be auto-applied

Clay-like thermally conductive material overcomes the weak points of conventional thermally conductive materials

Soft, Low-Adhesion, Thin and Stretchable

Freely deformable clay-like thermally conductive material



Soft and clay-like

- Highly deformable
- Fills 3D, curved surfaces and complex spaces

Superior handling and reworkability

- No flowing at room temperature, no pumping out at high temperatures
- No work process or installation site contamination

Has electrical insulation properties

- Usable around electric circuits and electronic components

Excellent thermal conductivity efficiency

due to high deformability compared to competitors' 5.7W/mK

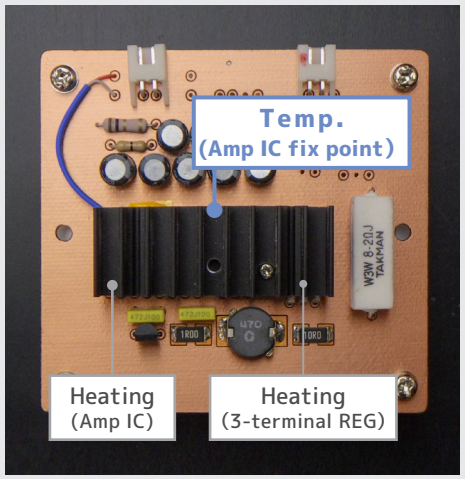
Comparison of IC temperature rise control by thermally conductive materials *Based on in-house assessment

Heat generated from amplifier ICs and 3-terminal regulators is measured at the temperature sensing part.

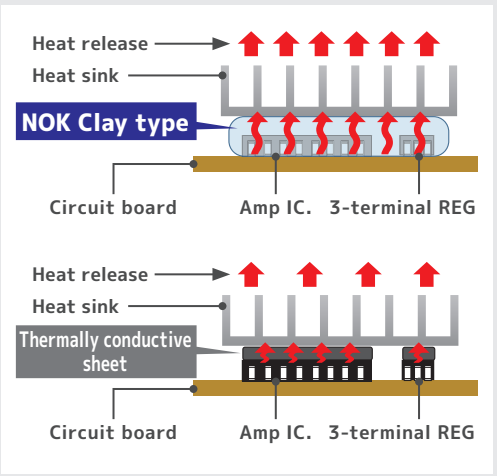
Comparing heat transfer effect heat sink: Competitor's thermally conductive sheet (5.7 W/m-K) vs.

NOK Clay Standard Grade and High Thermal Conductivity Grade.

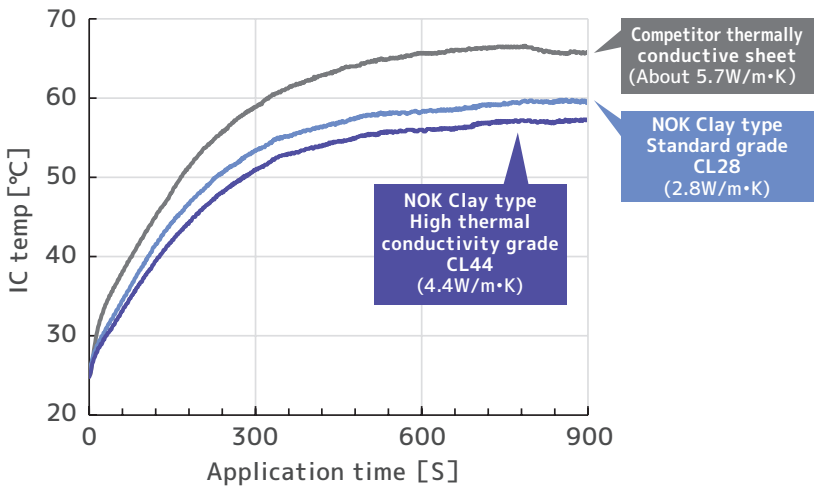
Circuit board heating and temperature sensing parts



Thermally conductive material Installation Configuration



Test Results



High thermal conductivity grade (CL44) is under development. Specifications are subject to change without notice.

Low Viscosity Specs Allow Dispensing Application...

...while retaining clay-like properties

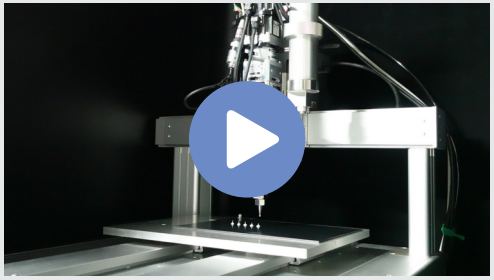
Low viscosity doubles application speed with improved followability.

*Based on in-house assessment

Softer than conventional products, with smoother application.

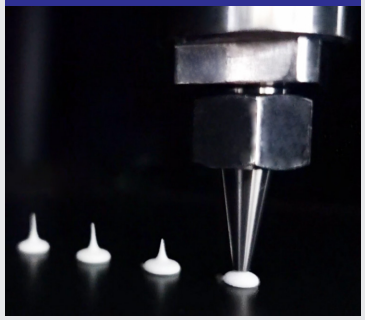
The result: application speed 2x that of conventional products, and faster line and dot application speeds. Of course, dispensing thick lines is also easy.

On top of that, improved followability enables adhesion to uneven surfaces and gaps on the heating surface with less force than conventional methods.

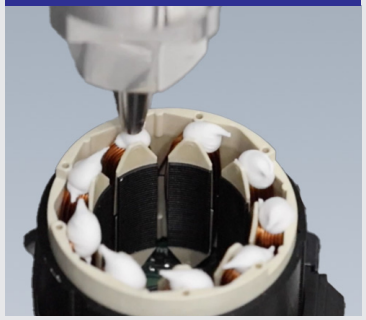


NOK Clay type introductory video

Motor coil application

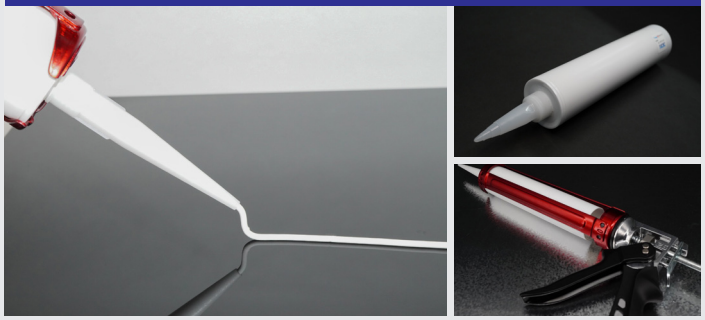


Motor coil application



Circuit board application

Can be applied with a store-bought cartridge gun

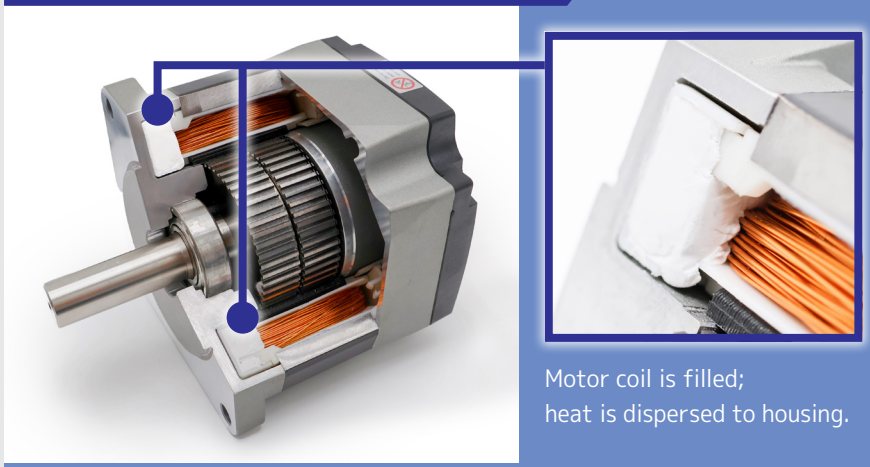


Dispenser grade (CLD31) is under development. Specifications are subject to change without notice.

Superior heat-resistance, insulation and deformability lets you

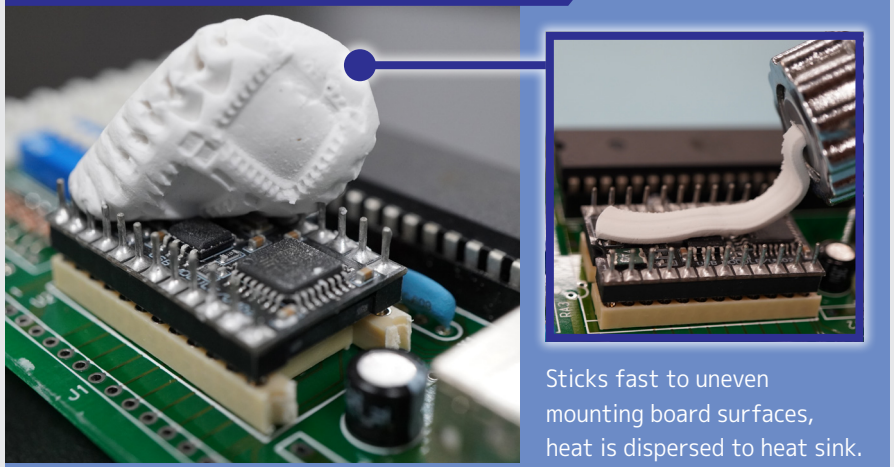
Use it where existing thermally conductive materials can't go

Application to a motor coil



Motor coil is filled;
heat is dispersed to housing.

Application to a circuit board



Sticks fast to uneven
mounting board surfaces,
heat is dispersed to heat sink.

Select from 3 types according to usage environment

New grade with both high thermal conductivity and heat resistance added

Item		CL28			CL44 (under development)			CLD31 (under development)			Test Method
Color		White			White			White			–
Specific weight		2.8			3.0			2.8			–
Hardness (unworked penetration)		120			120			220			JIS K2220
Thermal conductivity	W/m・K	2.8			4.4			3.1			Hot wire method
Recommended working temp.	℃	−40～200			−40～200			−40～150			–
Volume resistivity	Ω・cm	>2.7×10^{13}			>2.7×10^{13}			7.6×10^{12}			JIS K6249 (Drying treatment 105℃/24h)
Breakdown strength (AC)	kV/mm	7.6			8.4			4.5			JIS C2110
Voltage endurance(1min)	kV/mm	6.5			7.0			9.5			JIS C2110
Dielectric characteristics	Frequency	100Hz	1kHz	1MHz	100Hz	1kHz	1MHz	100Hz	1kHz	1MHz	–
	Relative permittivity	6.2	6.0	5.9	9.8	7.8	7.0	8.5	6.7	6.1	JIS C2138
	Dissipation factor	0.023	0.011	0.006	0.321	0.111	0.010	0.351	0.105	0.008	JIS C2138
Flame retardance		V-0 equivalent			V-0 equivalent			HBF equivalent			UL94
Low molecular siloxane (D3-D10) *Actual measured value	ppm	189			44			56			140℃×10min (GC/MS)

*NOK's Clay-like Thermally conductive material series is REACH and RoHS compliant. *CL44 and CLD31 grades are products under development. (specifications are subject to change without notice.)

Clay-like thermally conductive material is resistant to environmental changes

Heat transfer characteristics are stable over the long term from low to high temperatures

CL28		Untreated	−40℃ (1,000h)	150℃ (1,000h)	200℃ (1,000h)	85℃/95%Rh (1,000h)	-40℃⇔150℃ (each 30min×1,000cycle)
Hardness (unworked penetration)		120	115	–	130	185	125
Thermal conductivity	W/m・K	2.8	2.9	–	3.0	2.9	3
Breakdown strength (AC)	kV/mm	7.6	8.7	–	8.2	7.7	8.0
Volume resistivity	Ω・cm	$>2.7\times10^{13}$	1.5×10^{12}	–	$>2.7\times10^{13}$	2.3×10^{12}	$>2.7\times10^{13}$

CL44 (under development)		Untreated	−40℃ (1,000h)	150℃ (1,000h)	200℃ (1,000h)	85℃/95%Rh (1,000h)	-40℃⇔200℃ (each 30min×1,000cycle)
Hardness (unworked penetration)		120	120	–	120	80	115
Thermal conductivity	W/m・K	4.4	4.4	–	4.4	4.8	4.4
Breakdown strength (AC)	kV/mm	8.4	12.0	–	8.2	7.6	7.6
Volume resistivity	Ω・cm	3.6×10^{10}	8.4×10^{9}	–	$>2.7\times10^{13}$	2.5×10^{8}	$>2.7\times10^{13}$

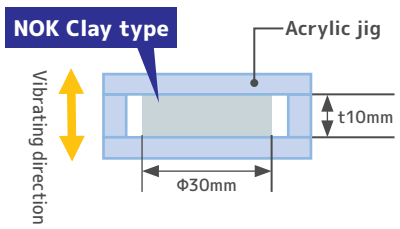
CLD31 (under development)		Untreated	−40℃ (1,000h)	150℃ (1,000h)	200℃ (1,000h)	85℃/95%Rh (1,000h)	-40℃⇔150℃ (each 30min×1,000cycle)
Hardness (unworked penetration)		220	210	190	–	205	195
Thermal conductivity	W/m・K	3.1	3.1	3.1	–	3.4	3.1
Breakdown strength (AC)	kV/mm	4.5	5.0	4.9	–	5.4	4.5
Volume resistivity	Ω・cm	3.0×10^{12}	2.8×10^{12}	2.4×10^{13}	–	9.2×10^{10}	1.3×10^{13}

Clay-like thermally conductive material is vibration-resistant

No peeling, shape change, or misalignment even in long-term vibration tests

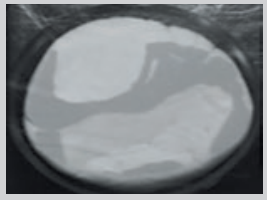
Pre-Test and Post-Test Comparison with CL28

Sample, peripheral jig structure



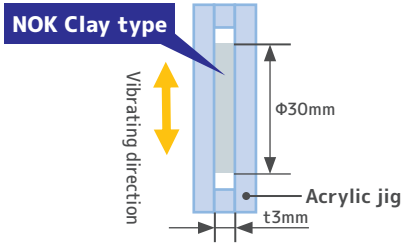
[Test conditions]
Ref. standard: ISO16750-3
Duration : 8 hours
Type : Random vibration test
Temperature : R.T.

▶Test movie

Observed surface	Board top	Board underside
Pre-vibration		
Post-vibration		

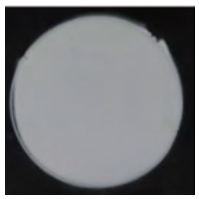
Pre-Test and Post-Test Comparison with 3 types

Sample, peripheral jig structure



[Test conditions]
Ref. standard: ISO16750-3
Duration : 8 hours
Type : Random vibration test
Temperature : R.T.

▶Test movie

仕様	CL28	CL44	CLD31
Pre-vibration			
Post-vibration			

Introduction of Sales Style and EC Sales Sites

Sales Style

※The CL44 and CLD31 packages under development are subject to change.

CL28 packaging

50g

500g

CL44 packaging

50g

CLD31 Packaging

Cartridge (900g/each)

Pail (18kg)

EC Sales Sites

*This site only handles CL28 products

As-1 AXEL Shop

AXEL GLOBAL powered by AS ONE

https://www.axel-gl.com/en/asone/d/64-0995-52/

Thermally Conductive Materials

Unlike conventional thermally conductive sheets,
NOK Thermally Conductive Material Series is a new type of thermally conductive material
that improves heat transfer and adhesion.
By utilizing NOK's technology that has been cultivated up to now,
it is possible to minimize the insulating layer of air between
the heat source and the heat dissipation material, and transfer heat efficiently.

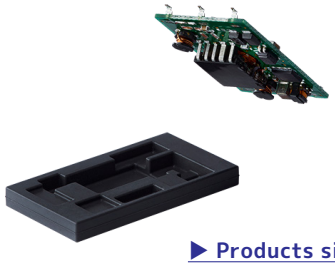
Product lineup

▶ Series Product Information

Clay-like thermally conductive material

▶ Products site

Thermally conductive rubber



▶ Products site

Hybrid thermally conductive materials

▶ Products site

Thermally conductive insulating resin

▶ Products site

Support

NOK supports your development

Dependable

NOK's products are backed by repeated research on the materials used and mechanical designs. They are highly dependable and have been used for many years in a wide variety of machines.

Technology development

NOK's self-contained development system covers the entire process from product design to product inspection. We actively integrate R&D and production technologies to create unique, cutting-edge technologies and products.

Material technology

Material technology is one of NOK's core technologies. We have been working on the material compounding and chemical analysis technologies needed to develop rubber and adhesives used in seal products.

Global development

NOK has established production bases around the world, including Japan, China, and elsewhere in Asia, and have built a stable supply system to meet our customers' needs.

For consultations and inquiries, feel free to **contact us using this form.**

Links

Get access to NOK's latest info

NOK posts the latest information on X(formerly Twitter) and YouTube.