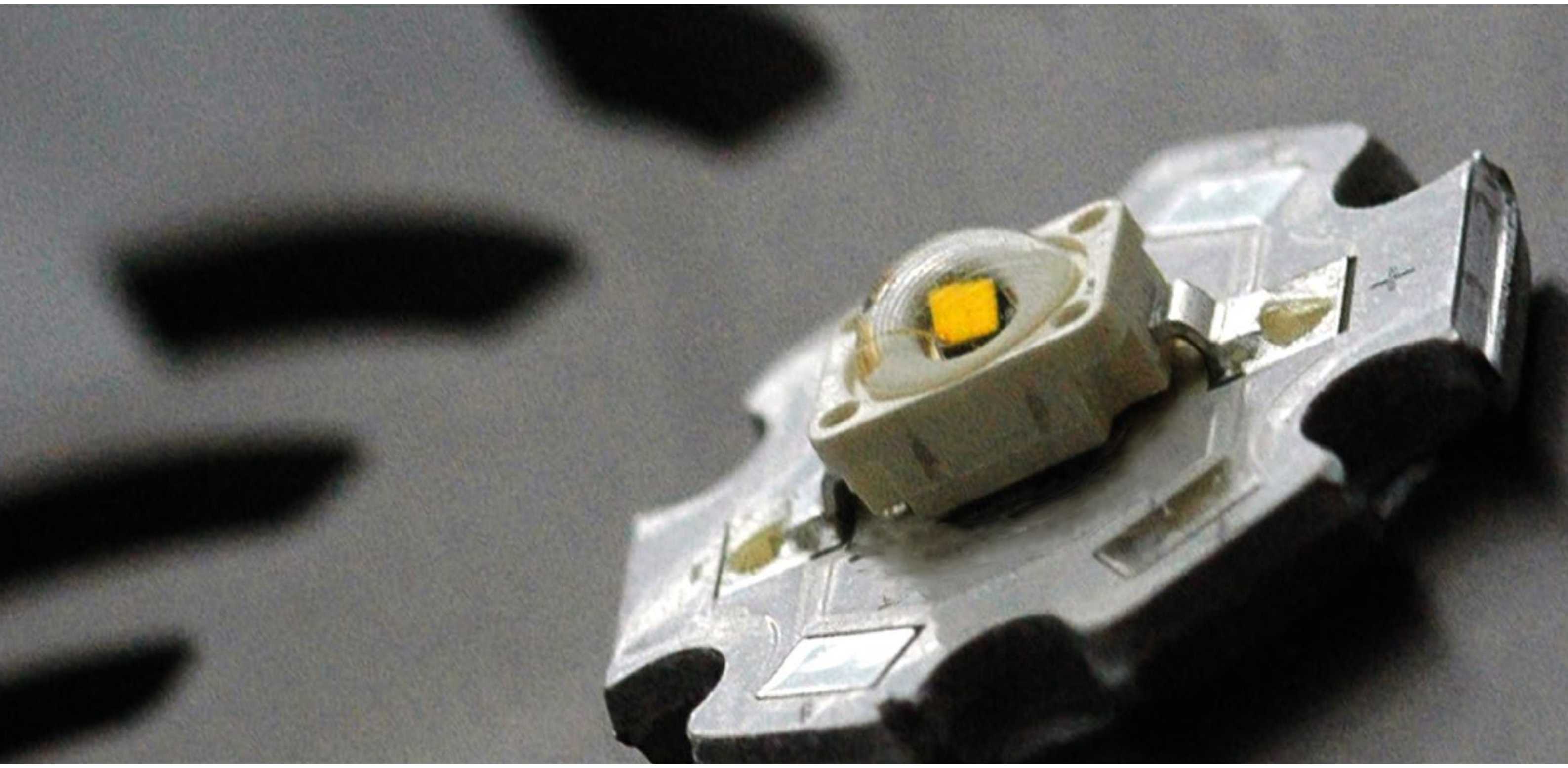


Thermally conductive adhesives
for frictional and heat-transferring connections in microelectronics, energy and electrical engineering

Product brochure

Thermally conductive adhesive bonding: an alternative to welding, soldering and mechanical joining

When used as a joining technique, thermally conductive adhesives fasten components to create a durable mechanical connection, while enabling heat to transfer from the warmer component to the colder component. Thus in many cases, thermally conductive bonding is an alternative to conventional connection processes such as soldering, welding or mechanical attaching.

What is thermal conductivity?

The thermal conductivity refers to a specific rate that describes the heat flow through a sample volume of a material and is measured in W/mK.

Typical values are as follows:

Thermally conductive adhesive:	~0.5 to 5 W/mK
Plastics without additives:	~0.2 to 0.3 W/mK
Glass, ceramics:	~1 to 30 W/mK
Metals, alloys:	~10 to 400 W/mK

Applications for thermally conductive adhesives

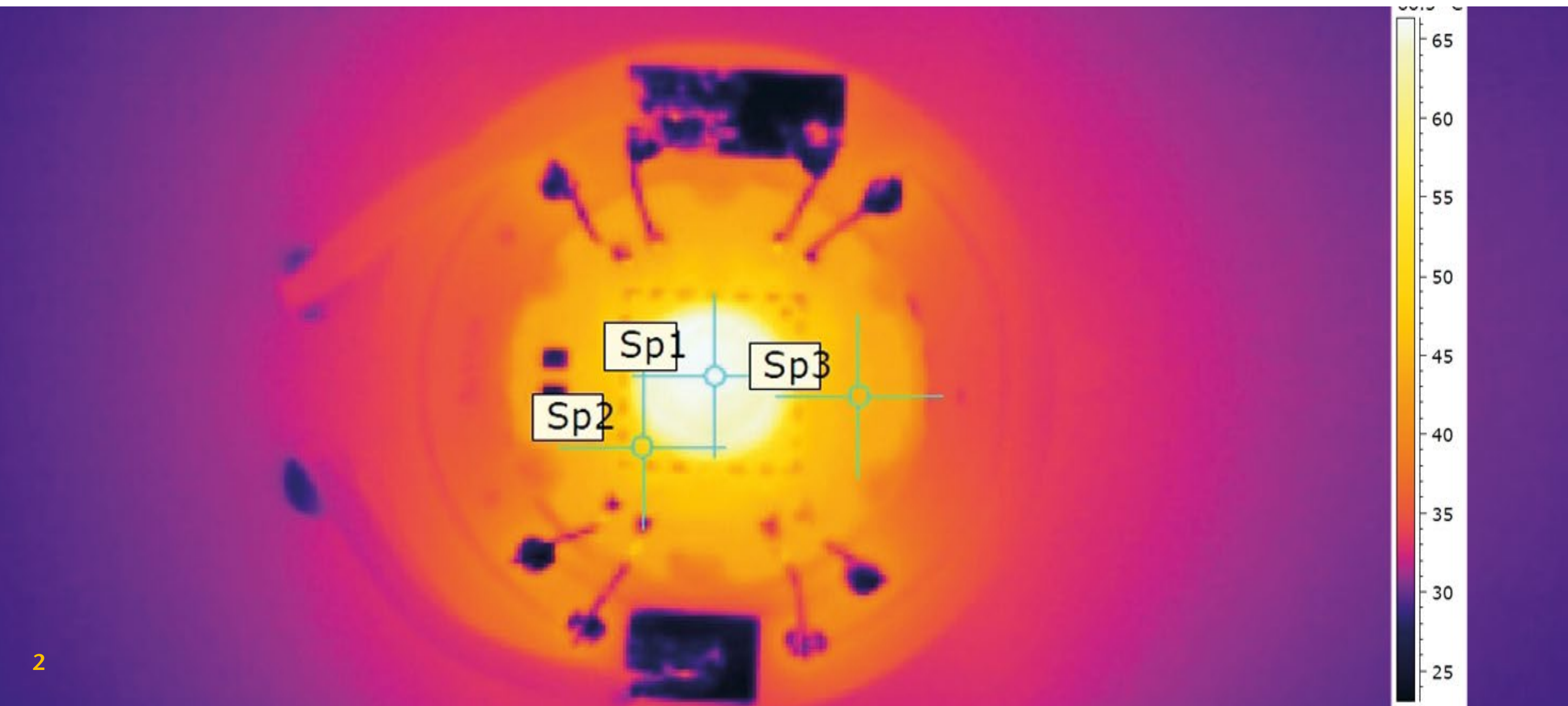
Good thermal management is essential for improving the service life of a final product by positively influencing its energy efficiency and environmental performance.

Thermally conductive adhesives are used in the following areas:

- **Microelectronics:** chip assembly, encapsulation, heat dissipation
- **Sensor technology:** potting of thermal sensors
- **Power electronics:** assembly of power modules
- **Energy engineering:** connection of pipes and surfaces in heat exchangers
- **Automotive engineering:** bonding and casting of battery cells, electric motors, and more

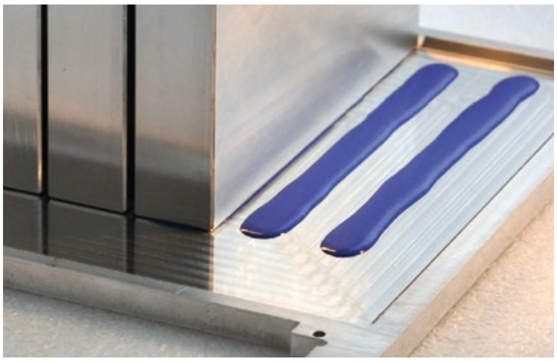
Advantages of adhesive bonding

In contrast to welding or soldering, thermally conductive adhesives can bond difficult combinations of materials such as copper and aluminum. These adhesives are gap-filling, thermally conductive over large areas and resistant to water, oil or gases. Given that the adhesives are cured at room temperature or moderate temperatures, neither mechanical stresses nor unwanted distortions or discolorations are generated during bonding.



The next generation of thermally conductive adhesives

New applications in energy and electrical engineering require ever higher levels of thermal conductivity. This was the reason a new generation of thermally conductive adhesives with a thermal conductivity of 1-4 W/mK or more has been developed. The following table lists both proven and newly developed products and will help choose the appropriate system with regard to processing and final properties.



Processing	Cold-cured	Hot-cured			
Components	2K	1K		2K	
Electrically insulating	Yes	Yes	No	Yes	No
<1 W/mK	TC 451 TC 417 TC 437	TC 351	–	TC 430	–
1-2 W/mK	TC 418 TC 432	–	TC 304 TC 301	TC 420 TC 418	–
2-4 W/mK	TC 423	–	–	TC 433 TC 423	–
>4 W/mK	–	–	EC 242 frozen	–	–

Thermally conductive pastes for temporary connections

In the event that thermally bonded parts must later be separated or replaced without being damaged, we offer pastes with thermal conductivities of 1-3 W/mK and application-oriented processing properties.

Variations and customized products

Do you need an unlisted product with specific characteristics? Many of our adhesives are also available as a less viscous, thixotropic, dyed or finished premixed and frozen version. We also develop customized products according to your specifications. Please contact us for more information.

Supported by:

Federal Ministry for Economic Affairs and Energy

on the basis of a decision by the German Bundestag

Thermally Conductive Adhesives

Product code	Processing properties					Thermal properties			Mechanical properties				
Parameter	Mix ratio by weight	Specific gravity	Viscosity	Pot life @ 23 °C	Cure schedule	Thermal conduc-tivity	Max. cont. service temp.	Glass transition temp.	Shore hard-ness	Lap shear strength	Tensile strength	Young's modulus	Elon-gation at break
Method	–	PT TM 201	PT TM 202*	PT TM 702	–	PT TM 502***	PT TM 302	PT TM 501	PT TM 601	PT TM 604	PT TM 605	PT TM 605	PT TM 605
Unit	–	g/cm³	Pa s	–	examples	W/mK	°C	°C	–	MPa (Al/Al)	MPa	GPa	%
TC 437	100:10	1.4	6	2 h	23 °C, 16 h	0.6 ±0.1	180	85	D80	16	42	5.8	0.9
TC 430	100:4	1.4	13	2 days	150 °C, 15 min	0.7 ±0.1	250	110	D85	11	44	5.6	0.9
TC 351	–	1.9	60	1 mon	120 °C, 45 min	0.8 ±0.1	200	87	D80	20	56	11	0.7
TC 417	100:13	1.8	3	6 h	23 °C, 24 h	0.8 ±0.1	180	80	D85	18	71	7.4	1.1
TC 451	100:6	2.0	9	30 min	23 °C, 16 h	0.8 ±0.1	180	110	D90	14	71	10	0.9
TC 420	100:11	2.1	22	24 h	120 °C, 15 min	1.1 ±0.2	200	90	D85	15	62	15	0.5
TC 304	–	1.8	35	1 mon	150 °C, 10 min	1.4 ±0.2	180	80	D85	17	65	7.4	1.6
TC 418	100:65	2.5	40-60**	4 h	23 °C, 48 h 120 °C, 30 min	1.6 ±0.2	160	<25	D36/ A94	3	2	0.04	3.0
TC 432	100:7	1.5	60-70**	15 min	23 °C, 24 h	1.8 ±0.2	190	75-80	D65	9	36	10	0.4
TC 301	–	2.0	43	1 mon	120 °C, 45 min	1.9 ±0.2	180	80	D85	23	59	12	0.8
TC 433	100:5	1.5	90-100**	6 h	150 °C, 15 min	2.0 ±0.2	220	110	D83	9	24	6.0	0.4
TC 423	100:1.7	3.0	50-80**	30 min	23 °C, 24 h 120 °C, 30 min	3.0 ±0.5	160	60 - 65	D92	10	29	23	0.1
EC 242 frozen	–	5.3	20	24 h	150 °C, 30 min	4.2 ±0.5	230	110	D85	7	34	9.0	0.4

* dynamic viscosity at 23 °C, plate-plate, gap 0.5 mm, shear rate up to 84 s^{-1}
** dynamic viscosity at 23 °C, plate-plate, gap 0.25 mm, shear rate constantly 10 s^{-1}
*** THB (transient hot bridge) method and/or laser flash measurements based on ASTM E1461
The above listed information are typical data and do not constitute specifications.

PB_Therm_conductive_adhesives_E
2022/10 - Technical specifications are subject to change without notice.

Polytec PT GmbH
Polymere Technologien
Ettlinger Straße 30
76307 Karlsbad
Tel. +49 7243 604-4000
Fax +49 7243 604-4200
info@polytec-pt.de

Polytec PT GmbH
Polymere Technologien
Betriebsstätte Maxdorf
Bahnhofstraße 1
67133 Maxdorf
info@polytec-pt.de

Polytec France S.A.S.
Technosud II
Bâtiment A
99, Rue Pierre Semard
92320 Châtillon
Tel. +33 1 496569-00
info@polytec.fr

www.polytec-pt.com