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Bioneer
Healthier Future for Humanity with Genomic Technology

AccuPaste™
CNT Heating and Conductive Paste

1. *AccuPaste*™ Heating Paste

Creating a New Era of Nano with CNT Heating Paste

- *AccuPaste*™ heating paste is composed of high performance carbon nanotube materials.
- High heat generating effect at low voltage and a coated film of thin thickness.
- Maintain the stable heat generating performance at high temperature (maximum 320 ℃)
- Possible applications for the electrode and the radiant heat material due to the high electric and heat conductivity.

Product Descriptions

- A coating layer maintains the heat-resisting property under high temperature environment (maximum 320 ℃) unlike the general heating paste.
- Temperature elevation rate of the *AccuPaste*™ is faster than the sheath heater, which is the existing nichrome line type, and electric efficiency is excellent from at low voltage.
- The incidence of air pollution, the noise, and electromagnetic waves is low due to using a radiant heat of CNT paste.
- Application field of *AccuPaste*™ heating paste can be classified with the heat generation material based on high heat conductivity, the ESD/EMI shielding material based on electric conductivity, and transparent conductive film for touch screen.
- The heating apparatus can be manufactured with the *AccuPaste*™, which has an excellent performance. And also it is able to manufacture a premium class product of a high-level and slim design.
- There are difficult to implement high performance heating apparatus due to the limitation of the existing materials, so the demand for high-performance new materials is increased. *AccuPaste*™ will meet these requirements.

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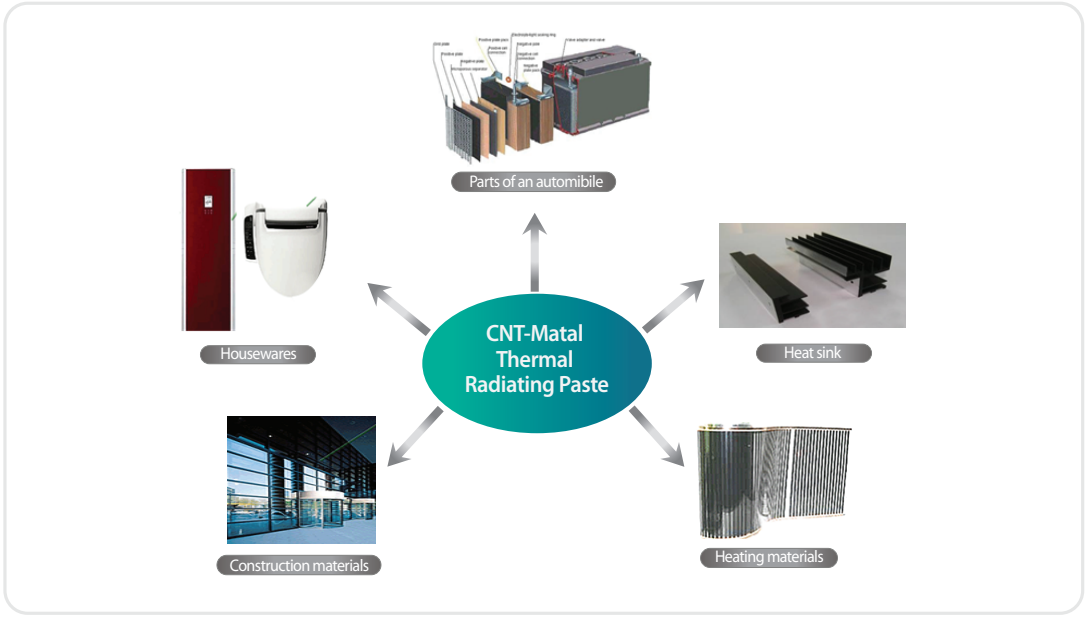
Applications of *AccuPaste*™ Heating Paste



The Features of *AccuPaste*™ Heating Paste

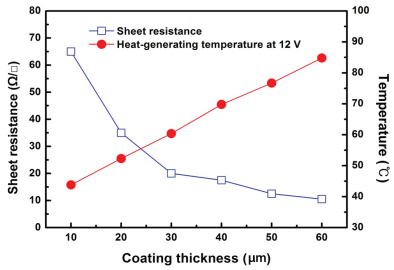
- Coefficient of thermal expansion of CNT nano-materials are lower than other materials (Coefficient of thermal expansion : -2 ~ +5 X 10^{6} K^{-1}), and dimensional stability is excellent.
- *AccuPaste*™ heating paste has a high stability for the most chemicals and solvents.
- There is no biological infringement or blazing fire.
- *AccuPaste*™ heating paste has a protective function for electromagnetic waves, because its occurrence strength during heat generating is low level that do not affect in a human body.
- The high heat conduction and the far-infrared radiation ability are possible heating of the wide space by instantaneous heat generating and far-infrared radiation.
- Far-infrared has a physiological activity effect because of the resonance effects through water molecules existing in the living body.
- The high heat conductivity is usable to electronic material or heat material for industry.
- *AccuPaste*™ heating paste has low sheet resistance (about 76 Ω /□) at 10 μm of coating thickness.

Specification of Product

Classification	Specification	Note
Main component	Ceramic Resin	
Appearance	Black	With eyes
Workable temperature	-20 ~ 320℃	
Viscosity (cP)	About 430,000	Rotational Rheometer
Drying condition	30 min at 300 ℃	Hot-air drying
Sheet resistance (Ω/□)	About 7.6 x 10^{1} (10 μm coating thickness)	ASTM D991
Volume resistivity (Ω•cm)	7.7 x 10^{-2}	ASTM D991
Storage condition	Room temp.	Sealing

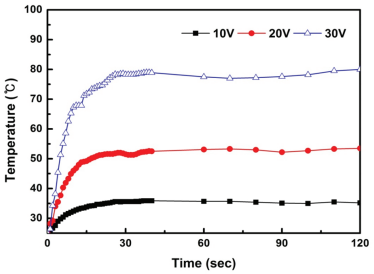
Properties of *AccuPaste*™ Heating Paste

1-1. Comparison of sheet resistance and heating performance depending on the thickness.



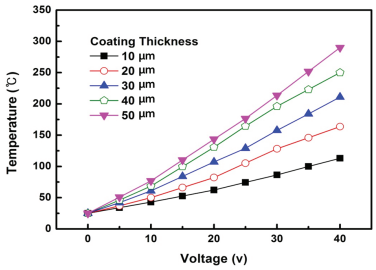
- This graph shows to comparison of sheet resistance and heating value depending on the coated film thickness at 12V.
- The result shows low sheet resistance and high heating temperature at thick coated film under 12V.

1-2. The heating performance depending on time at 10V, 20V, and 30V.



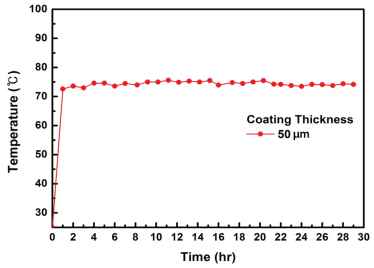
- This result shows to heating temperature depending on each voltage.
- According to graph, heating temperature and heating rate were higher as increasing the voltage. And maximum heating temperature is reached within 30 second.

1-3. Heat stability test of a coating layer depending on temperature.



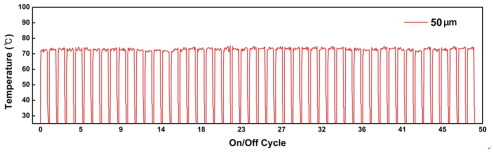
- This results show to comparison of temperature change along the voltage with the coating thickness.
- Heating temperature is higher as increasing the coating thickness and applied voltage
- From the graph, the temperature of heating is reached 300℃ at 40V and 50 μm.

1-4. Heating stability test depending on time.



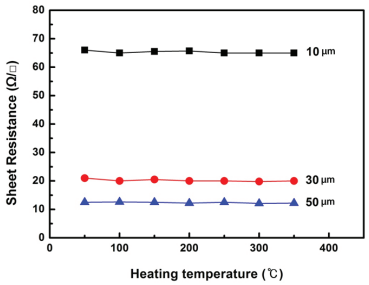
- This result shows to temperature change development for 30 hours at 50 μm coating film under 12 V.
- After reaching at 73℃ within 30 seconds, the surface temperature was kept to 73℃ for 30 hours.

1-5. Heating stability test for On/Off cycle.



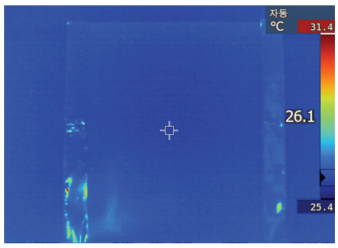
- This result shows to temperature stability of heating paste for 50 times on/off cycle at 50 μm coating film under 12 V.
- As the result, the surface temperature was kept to 73℃ for 50 times on/off cycle.

1-6. Heat stability test of a coating layer depending on temperature

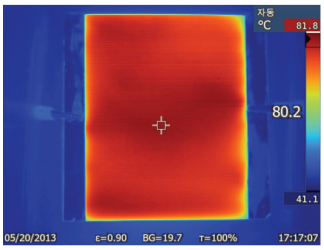


- This result shows to temperature stability of coating layer after heat treatment.
- As the result, a coating layer is very stable and keep the constant sheet resistance after heat treatment from 50℃ to 350℃ .

1-7. Heating test under 12 V at 50 μm coating film.



• Before heating of *Accupaste*™ coating film

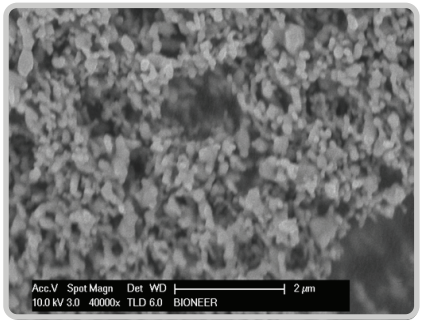


• After heating of *Accupaste*™ coating film

2. *AccuPaste*™ Conductive Paste

- Conductive paste is composed of silver nano powder and high performance carbon nanotube materials.
- Maintain the stable conductive property without detachment at 320℃.
- Excellent adhesion property for various materials.
- *AccuPaste*™ conductive paste has very low sheet resistance (3.1 x 10^{-2} Ω/□) at 25 μm of coating thickness.
- The possible application of conductive paste is an area about various electrode fabrications that can be used at low and high temperature.

• Appearance of conductive Paste



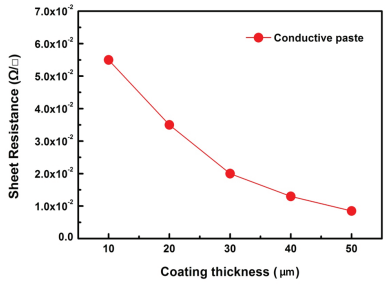
• Surface image after conductive paste coating

Specification of Product

Classification	Specification	Note
Main component	Ag nano powder & Carbon Nanotube	
Appearance	Yellowish green	With eyes
Workable temperature	-20 ~ 320 °C	
Viscosity (cP)	240,000	Rotational Rheometer
Drying condition	30 min at 300 ℃	Hot-air drying
Sheet resistance (Ω/□)	3.1 x 10^{-2} (25 μm coating thickness)	ASTM D991
Volume resistivity (Ω•cm)	7.6 x 10^{-5}	ASTM D991
Storage condition	Room temp.	Sealing

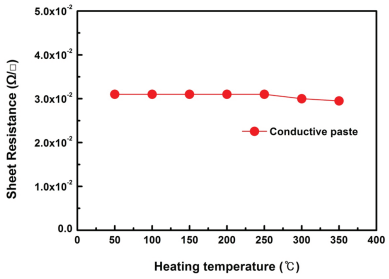
Properties of *AccuPaste*™ Conductive Paste

2-1. Sheet resistance depending on coating thickness.



- This graph shows sheet resistance value depending on the coated film thickness.
- The result shows low sheet resistance as increasing coated film thickness (minimum 8.5 x 10^{-3} Ω/□ at 50 μm thickness film).

2-2. Stability test of conductive coating film depending on temperature.



- The graph shows the stability of coating film depending on each temperature.
- As the result, a coating film is stable from 50 °C to 350 °C without sheet resistance change.

3. *AccuPaste*™ Insulating Paste

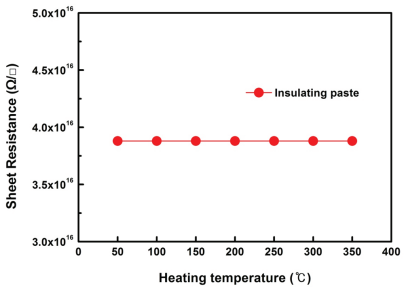
- Stable insulating property without detachment at 320 °C.
- Favorable adhesion for various materials.

Specification of Product

Classification	Specification	Note
Main component	colorless and transparent	With eyes
Viscosity (cP)	130	Rotational Rheometer
Workable temperature	-20 ~ 320 °C	
Sheet resistance (Ω/□)	3.9 x 10^{16} (50 μm coating thickness)	ASTM D257
Drying condition	30 min at 300 ℃	Hot-air drying
Storage condition	Room temp.	Sealing

Properties of *AccuPaste*™ Insulating Paste

3-1. Stability test of conductive coating film depending on temperature.



- The graph shows the stability of coating film depending on each temperature.
- As the result, a coating film is stable from 50 °C to 350 °C without sheet resistance change.

Ordering Information

Cat. no.	Specification	Size	Price
CNT Heating Paste:			
TC-1000-1	CNT Heating Paste	100 ml	Inquire
TC-1000-2	CNT Heating Paste	500 ml	Inquire
TC-1000-3	CNT Heating Paste	1 L	Inquire
Conductive Paste:			
TC-4000-0	Silver Conductive Paste	50g	Inquire
TC-4000-1	Silver Conductive Paste	100 g	Inquire
TC-4000-2	Silver Conductive Paste	500 g	Inquire
TC-4000-3	Silver Conductive Paste	1 kg	Inquire
Insulating Paste:			
TC-5000-1	Ceramic Insulating Paste	100 ml	Inquire
TC-5000-2	Ceramic Insulating Paste	500 ml	Inquire
TC-5000-3	Ceramic Insulating Paste	1 L	Inquire

Legal Statement

AccuPaste™ CNT Paste technology is covered under Korea patent 10-1313149, 10-1447478, Korea patent application 10-2012-0026735 and its corresponding international patent application.

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