

## **Introduction**

Centering for LEED thick film ink for stainless steel substrate, Electronic material division of Hunan LEED investment co., Ltd has provided every effective technological solutions to meet every customer for different applications and dedicated to take advantage of thick film technology to innovate and improve lives of human being.

The series of LEED thick film paste for stainless steel substrates, the basic material for thick film circuit on steel, are the supported project of “863 plans” cooperated with National University of Defense Technology. We have completely autonomous intellectual property. Through “screen-printing, drying and sintering”, LEED thick film paste is designed to print insulated layer, resistor layer, conductive layer and covering layer on the stainless steel substrate and made out thick film heating element, power resistance, printed circuit. According to its different usage, it has dielectric paste, resistor paste, conductor paste.

LEED thick film paste is an environmental poisonous element free material property up to European RoHS regulation. JZ4301 is the insulating material for 430-type ferritic stainless steel. The thickness of thick film, after printing three times of dielectric paste, can reach more than 80 $\mu$ m and high breakdown voltage is more than 2000VAC/1 min. Besides, its TEC closely matches that of stainless steel. And it has strong adhesive power with little distortion. Conductor paste DT 4306A featuring strong adhesive power, excellent soldering resistance and environmental protection can meet conditions of thick film heating element. DZ430XXXX is a resistor paste compatible for dielectric paste and conductor paste. The first two XX plus 10 is resistivity. The unit is m $\Omega$ / $\square$ . The latter two XX plus 100 is TCR(the temperature coefficient of resistance). The unit is ppm/..It has features of big power intensity, high working temperature, small change of resistance after refiring. The resistivity of DZ430XXXX ranges from 50 m $\Omega$ / $\square$  to 500 m $\Omega$ / $\square$  and TCR is from 300ppm/ $^{\circ}$ C to 3300 ppm/ $^{\circ}$ C. The intermediate resistivity can be obtained by lending the two members of a TCR group and have insulating medium JZ4301 been printed to protect

circuit.

The thick film heater applied to small bulk and high heating speed apparatus has features of uniform heating scope, long lifetime (>100000hours), high thermal efficiency, big mechanical intensity, safety and environmental protection. It is the brand new heater technological revolution which can be widely applied to household appliance, automobile appliance, instrument and meter, post and communication, aerospace and military. The main thick film elements available are electric heater on steel, timing resistor of air-condition, heating element for straight hair styler.

Boast of keeping positive and aggressive attitude, guaranteeing the quality supervision and having the strong responsibility and high working efficiency, our company can provide our customers excellent products and in- time services. We are aimed at using science and technology to improve our lives and benefit our future and the whole world.

## Appendix

### Patent certificate:



### Letters patent of conductor paste



### Letters patent of resistor paste



### Letters patent of dielectric paste

## Dielectric paste JZ4301

LEED JZ4301 is dielectric paste for 430-type ferritic stainless steel which features excellent insulating property, small distortion, strong adhesive power, good printing performance and toxic element free up to European RoHS environmental regulation. LEED JZ 4301 and LEED DZ 430 XXXX Resistor paste, compatible perfectly with LEED DT430X conductor paste, are key materials for thick film resistors and heating element. It is recommended the lustration grade of appliance and circumstance to be more than one thousand degree.

### Paste data

Mm	Material of substrate	430-type (1Cr17) stainless steel
	Composition	Glass particles, Organic solvent
	Form & color	Paste form, Cambridge blue or black, or gray
	Rheology	Thixotropic, screen printable paste
	Viscosity	70±20Pa·s ( Brookfield RVT, ABZ Spindle, 10 rpm, 25°C±1°C, 10rpm)
	Maximal particle size	<18µm
	Solid content	76±1%
	Shelf time	6 month (5~10°C)

### Processing

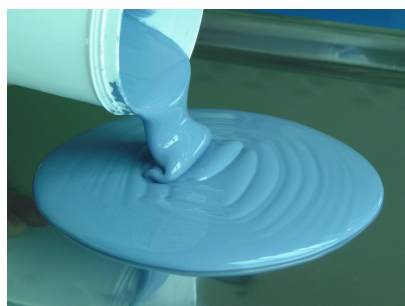
Screen mesh	145 stainless steel screen(e.g., SD118/56,BOPP), Or 165 stainless steel screen (e. g., SD100/50,BOPP)
Leveling time	2~3 minutes
Drying temperature time	120~150°C / (>12minutes)
Firing	Range of peak temperature: 850°C-900°C
	The perfect Firing temperature: 865°C

	Firing time at peak temperature: >10 minutes
	Time of ascent/descent: 10~12 minutes
Thinner	LEED JZ-XS

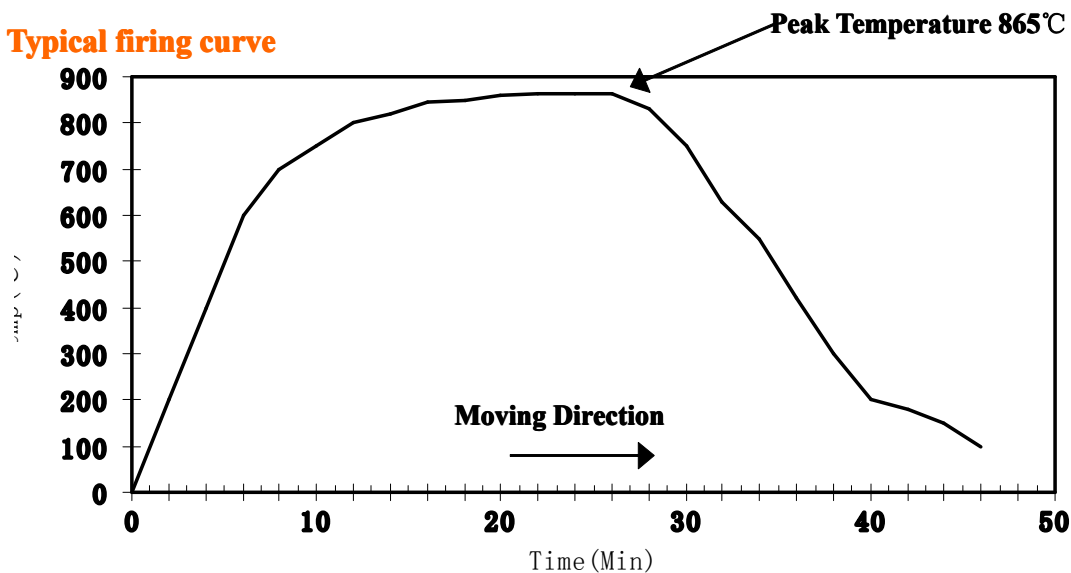
## Typical properties

Fired thickness	>80 $\mu\text{m}$
Breakdown voltage	>2000 VAC/min( fired thickness of dielectric > 80 $\mu\text{m}$ , 25°C)
Insulation resistance	>10 <sup>9</sup> $\Omega$ (500 VDC, 25°C)
Approximate Coverage	~30cm <sup>2</sup> /g ( fired thickness:80 $\mu\text{m}$ )
Constant dielectric	$\epsilon=8.2$
Working temperature	Maximal working temperature:450°C
Compatible materials	Conductive paste: LEED DT430X
	Resistive paste: LEED DZ430XXXX
	Protective overglaze: LEED JZ4301

## Picture of product



## Typical firing curve



**Notice of usage and storage**

1. The lustration grade of appliance and circumstance should be ten thousand degree before screening and drying
2. Stainless steel substrate should get rid of nick and burr on surface.
3. The operator must wear glove or fingertip to preventing from fingerprint pollution.
4. The used material should be collected and sealed up alone. Don't mix with other untapped material.
5. Before using the paste, it is essential to take out of from icebox or icehouse firstly and place it at about 25°C beyond 12 hours. Keep stir it slowly and fully till the composition of this paste is uniform.
6. It should be guarantee that the room temperature and appliance temperature remains  $26\pm 2^{\circ}\text{C}$  during printing.
7. Paste material placed on the screen should be moderate when making screen-printing and added regularly.
8. Dilute the paste moderately to recover the printing performance.
9. The storage temperature is recommended between 5 and 10°C. The shelf time is commonly 6 months.

## Resistor paste DZ430XXXX

LEED DZ 430XXXX series are low value resistive paste designed for heating elements on stainless steel substrate. The first two XX plus 10 is resistivity. The unit is  $m\Omega/\square$ . The last two XX plus 100 is TCR (the temperature coefficient of resistance). The unit is  $ppm/^{\circ}C$ . It has features of big power intensity, high working temperature and small change of resistance after refiring. The resistivity of DZ430XXXX ranges from  $50 m\Omega/\square$  to  $500 m\Omega/\square$  while TCR ranges from  $300ppm/^{\circ}C$  to  $3300 ppm/^{\circ}C$ . Intermediate resistivity may be obtained by lending the two members of a TCR group. Having good compatibilities with LEED dielectric paste and conductor paste, LEED DZ 430XXXX can directly apply to alumina ceramic substrate for making thick film circuit.

### Paste data

Composition	Ag, Pd, Glass particle, Organic solvent
Form & color	Paste form, gray
Rheology	Thixotropic, screen printable paste
Viscosity	$210\pm 25 Pa\cdot s$ ( Brookfield RVT, ABZ Spindle, 10 rpm, $25^{\circ}C\pm 1^{\circ}C$ , 10rpm )
Maximal particle size	$< 18\mu m$
Solid content	$81\pm 1\%$
Density	$\sim 2.93g/cm^3$
Shelf life	6 months ( $10^{\circ}C$ )

### Processing

Material of substrate	print LEED JZ4301 on 430 type stainless steel substrate
Screen mesh	300 stainless steel screen (e. g., SD56/32,BOPP)
Leveling time	At room temperature, 2~3min

Drying temperature	120~150℃ /(>15min)
Firing	Range of peak temperature: 850℃-870℃
	Firing temperature: 865℃
	Preservation time of peak temperature: >15min
	Time of ascent/descent: 10~12 min
Thinner	LEED DZ-XS

**Typical property**

Fired thickness	12±1 μm
Approximate coverage	~80cm <sup>2</sup> /g (fired thickness:12μm)

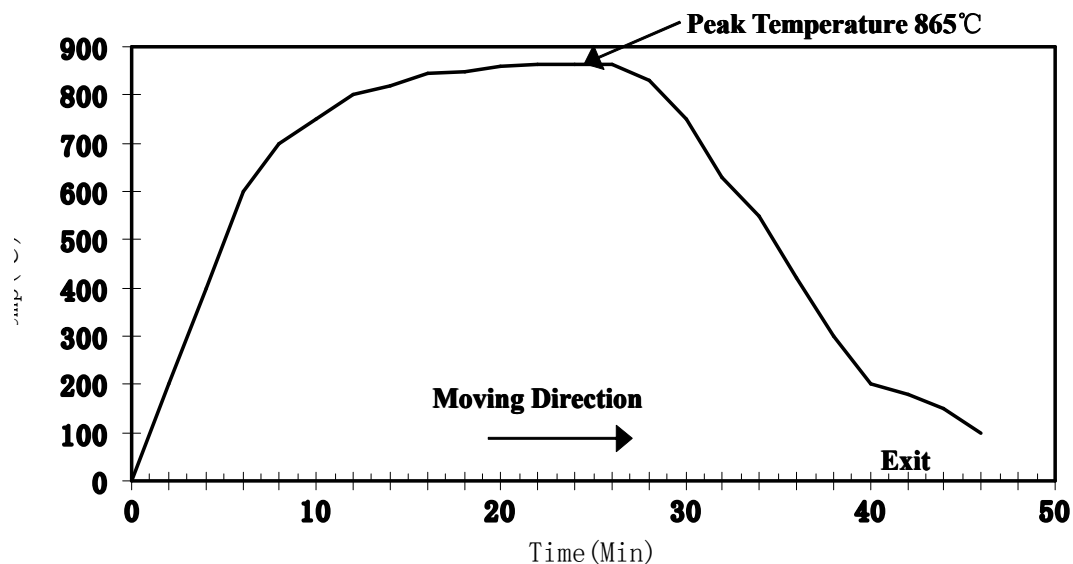
Resistivity and TCR

Form 1 Resistor property			
Number of product	Resistivity (mΩ/sq) ±10%	TCR(ppm/℃)	Tolerance of TCR (ppm/℃)
DZ4301003	100	350	50
DZ4302003	200	350	50
DZ4301006	100	600	50
DZ4302006	200	600	50
DZ4301009	100	900	50
DZ4302009	200	900	50
DZ4301015	100	1500	50
DZ4302015	200	1500	50
DZ4303015	300	1500	50
DZ4304015	400	1500	50
DZ4305015	500	1500	50



DZ4301030	100	3300	50
DZ4302030	200	3300	50

### Typical firing curve



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4. The used material should be collected and sealed up alone. Don't mix with other untapped material.
5. Before using the paste, it is essential to take out of from icebox or icehouse firstly and place it at about 25°C beyond 12 hours. Keep stir it slowly and fully till the composition of this paste is uniform.
6. It should be guarantee that the room temperature and appliance temperature remains 26±2°C during printing.
7. Paste material placed on the screen should be moderate when making screen-printing and added regularly.
8. Dilute the paste moderately to recover the printing performance.
9. The storage temperature is recommended between 5 and 10°C. The shelf time is commonly 6 months.

### Silver conductor paste DT4306A

LEED DT4306 A is an environmentally conductor paste designed for thick film circuit on stainless steel substrate. It is toxic element free up to European RoHS environmental regulation which has features of strong adhesive power, good weldability, excellent ageing resistance, small resistivity and good rheology. DT4306 is also designed on ceramic substrate to make environmental resistance piece, consumed hybrid integrated thick film circuit, ceramic capacitor, filter and household appliances.

#### Paste data

Composition	Noble metal, Organic solvent
Form and color	Paste form, silver gray
Rheology	Thixotropic, screen printable paste
Viscosity	180±20 Pa·s( 10 rpm, 25°C±0.5°C)
Maximal particle size	<18µm
Solid content	81±1%
Shelf time	6 months (5~10°C)

#### Processing

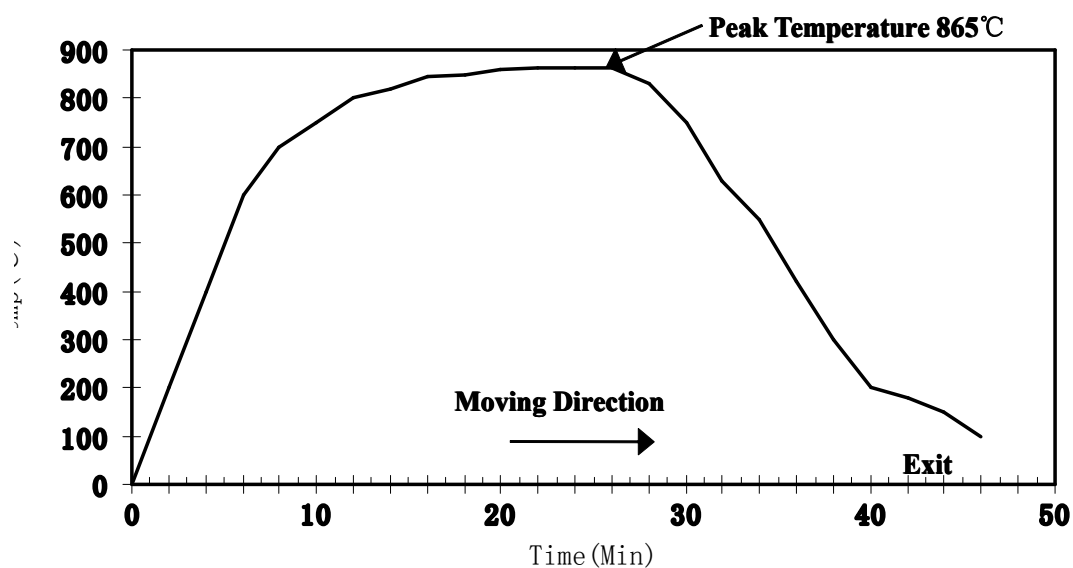
Material of substrate	96% alumina substrate
Screen mesh	200 stainless steel screen (ie.SD90/40,BOPP)
Leveling time	room temperature, 2~3min
Drying temperature	120~150°C /(>15 min)
Firing	Range of peak temperature: 850°C-900°C
	The perfect sintering temperature: 865°C
	Preservation time of peak temperature: >10min
	Time of ascent/descent: 10~12min

Thinner	LEED DZ-XS
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## Typical property

Fried thickness	20±2 μm
Approximate coverage	~50cm <sup>2</sup> /g (Fried thickness :20μm)
Conductivity	≤ 4mΩ/sq. (Fried thickness 20μm)
Weldability	good
Adhesive strength	40~80 N N(rise upright, 2.0 mm x 2.0 mm,62 Sn/36 Pb/2 Ag,220°C±5°C)
	Ageing in 48 hours at 150°C: ≥35 N

## Typical firing curve



## Notice of usage and storage ;

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6. It should be guarantee that the room temperature and appliance temperature remains  $26\pm 2^{\circ}\text{C}$  during printing.
7. Paste material placed on the screen should be moderate and added regularly when making screen-printing.
8. Dilute the paste moderately to recover the printing performance.
9. The storage temperature is recommended between 5 and 10°C. The shelf time is commonly 6 months.