DuPont LF911

Pb FREE Cu ELECTRODE COMPOSITION FOR Al2O3 SUBSTRATE

Technical Data Sheet: Dec,2015

Product Description

LF911 is a screen printable & 900degC N2 fireable, solderable and platable Lead free Copper electrode composition designed for wide variety of hybrid & component applications. So that you can explore any kind of potential application development by N2 firing.

Key Features

- Excellent Adhesion on Alumina substrate
- Lead free
- Low resistivity
- Ni platable (Electrolytic plating)
- Solderable with both lead free and lead solder
- Low materials cost vs. Silver conductor

Composition Properties

Composition Properties	
Viscosity (Pa.s) (Brookfield 2xHAT, Utility cup & spindle (SC4-14/6R, 10 rpm, 25 ± 0.2℃)	170-230
Inorganic Solids (w%) @900℃ N2	90.5-92.5
Fineness of grind (4th scratch / 50% point; um)	< 20/10
Coverage (cm^{2}/g) (@15/20um fired thickness)	73 / 55
Sheet Resistivity Fire: 900degC / total 60min.N2 profile	≦2.0mΩ/□ @20μm fired

Fired Properties

Other Properties	
Viscosity Ratio (0.5/10rpm)	5-6 (1110Pas / 207Pas)
Dried Thickness (recommend)	22-28um
Fired Thickness (recommend)	15-20um
Fired Shrinkage (Dried-Fired)/Dried Thickness %	27-33%
Fired Surface Roughness	Ra = 0.5-0.6um Rmax = 3.5-4.5um
Resistivity	2.5 μΩcm
Solderability (Solder Ball Spread) Pb/Sn, 240C 30sec	220-240%
Solderability (Solder Ball Spread) Pb free, 260C 30sec	160-180%
Initial Adhesion and typical peel mode** (both Pb/Sn and Pb free solder)	≧20N B
Ni Plated Initial Adhesion and typical peel mode	≧20N A
150C 1000hrs Aged Adhesion and typical peel mode	≧20N B
-40⇔150C x 500 cycle Thermal Cycle Adhesion and typical peel mode	≧10N B

Data are technical reference, and we do not assure the value.

** peel mode: peeling / fracture at:
A: substrate-electrode boundary or inside substrate
B: inside electrode
C: inside solder

Sample Sales will be available from Dec.2015 as soon as scale up batch is available. And product set up is completed in US, Europe and Asia.

Recommended Process Conditions

Printing

The composition must be thoroughly mixed before use. This is best achieved by slow, gentle, hand stirring with a clean, preferably plastic spatula for several minutes. Care must be taken to avoid air entrapment. Printing should be performed in a clean and well ventilated area.
Note: optimum printing characteristics are generally achieved in the room temperature range of 20℃-23℃ . It is therefore important that the material, in its container, is at this temperature prior to printing.
Print screen ; SUS250-325, Emulsionμm
Squeegee speed ;00mm/sec
Target thickness: 22-28 μ m dried, 15-20 μ m fired.
Screen mask is SUS250-325 mesh x 10-20um emulsion to get the thickness.
Shipping test is done printed on 96% Al2O3 substrate

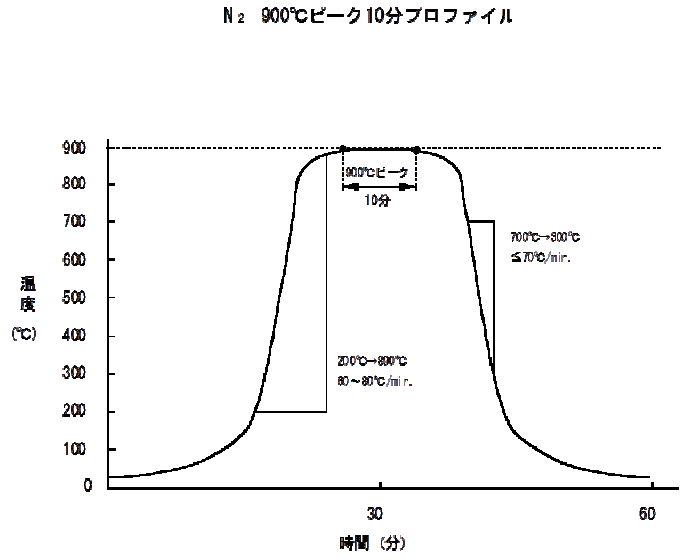
Drying

It is recommended to apply max 120degC 10min in order to prevent oxidization of Cu power which may cause unusual fired properties.

Storage of dried parts: No serious issue has been reported in our lab as long as dried parts are storaged in dry box @<20%RH for 3 months.

Firing

Recommended firing profile is N2 900degC peak 10min, total 60min. profile shown below. Please contact account sales person for detail guidance.
200→890C: 60-80C/min
700→300C: <70C/min



Plating

LF911 is platable. Ni electrolytic plating (2-5 μ m thick) is applied as Au's underneath layer. (Au thickness <2 μ m).

Soldering

LF911 is solderable with both Pb/Sn and Pb free solder. It is recommended to optimize solder reflow conditions at users as DuPont's test data is based on solder dipping and solder ball. Adhesion data is available in this datasheet.

Thinner

DuPont 9450 (Texanol) is recommended thinning solvent.
The use of too much thinner or the use of a non-recommended thinner may affect the rheological behavior of the material and its printing characteristics. Refer to table - "Composition Properties"

Storage and Shelf Life

Containers may be stored in a clean, stable environment at room temperature (between 5℃ - 30℃), with their lids tightly sealed. Storage in high temperature (>30℃) or in freezers (temperature < 0 ℃) is NOT recommended as this could cause irreversible changes in the material. The shelf life of compositions in factory-sealed (unopened) containers, stored under refrigerated (between 5℃ - 30℃) conditions is 3 months from date of shipment. In general, viscosity tends to go up slightly over time.

General

Yield and performance will depend to a large degree on care exercised during processing, particularly in screen printing. Scrupulous care should be taken to keep the composition, printing screens and other tools free of metal contamination. Dust, lint and other particulate matter may also contribute to poor yields.

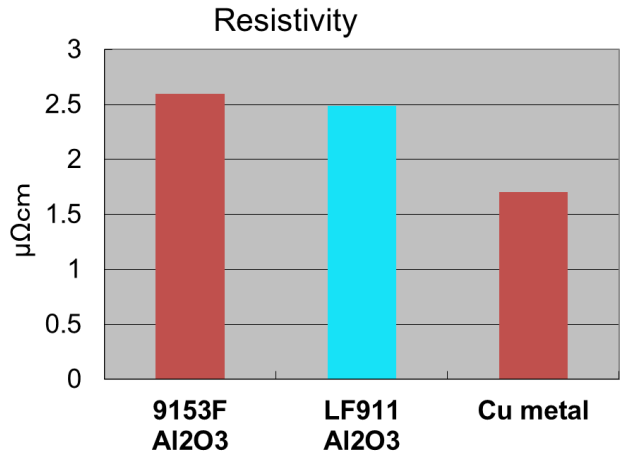
Safety and Handling

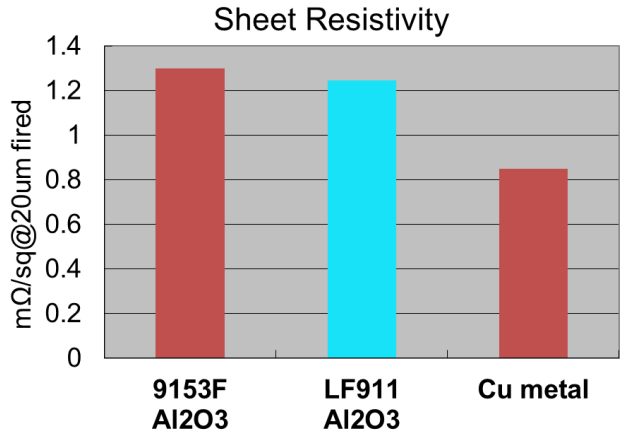
For Safety and Handling information pertaining to this product, read the Material Safety Data Sheet (MSDS).

Typical/Reference Data

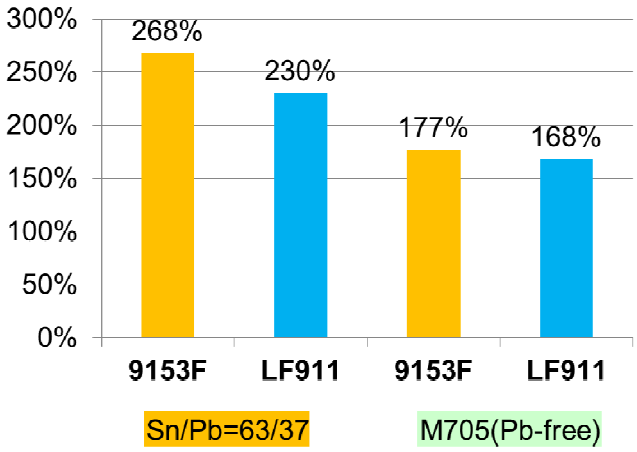
Resistivity

LF911 resistivity is slightly lower than 9153F, having x1.5 of Cu metal.





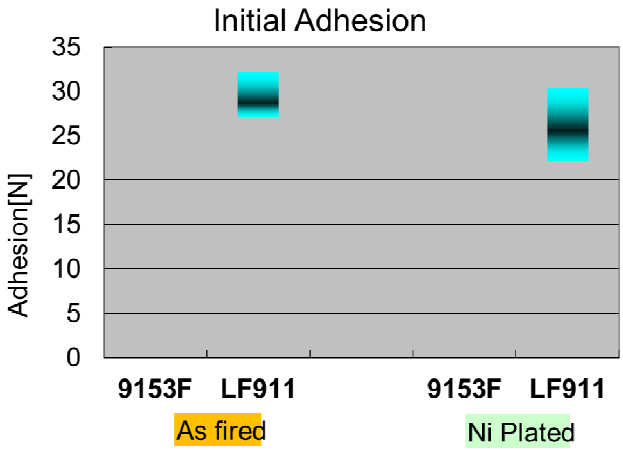
Solder Ball Spread



LF911 is solderable with both Sn/Pb and Pb free solder. Users can improve solderability by oprimizing reflow conditions. Above test was done with 240C 30sec for Sn/Pb and 260C 30sec for M705. Data in % means relative spread diameter vs. solder ball before melting .

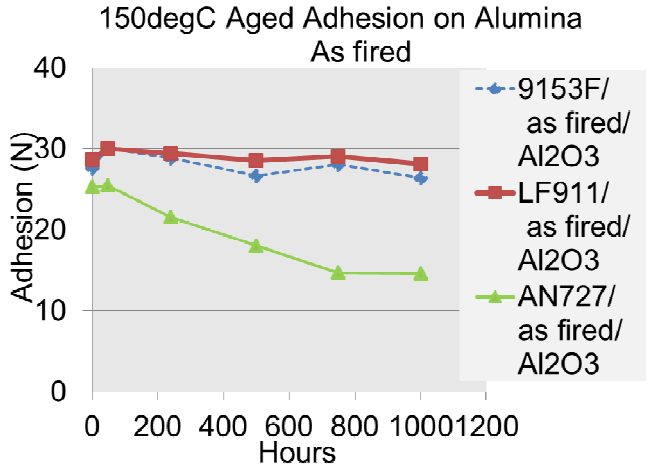
Initial Adhesion w/ & w/o Ni plating

Initial adhesion is over 20N w/ and w/o Ni plating.
Peel mode of “Ni plated” is A while “As fired” is B.



150C Aged Adhesion and Peel Mode

As fired



Main Peel Mode

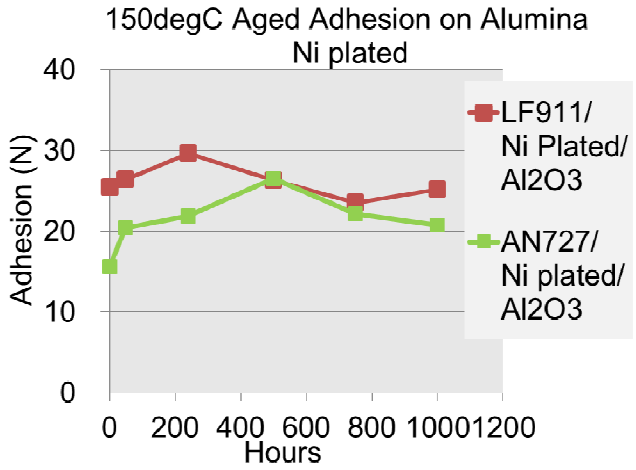
	Init	48h	240h	500h	750h	1000h
9153F	A	A	A	B	B	B
LF911	B	B	B	B	B	B
AN727	B	B	B	B	A	A

Solder: Pb free (M705)

** peel mode: peeling / fracture at:
A: substrate-electrode boundary or inside substrate
B: inside electrode
C: inside solder

LF911 as fired aged adhesion strength is equivalent to 9153F (Lead containing Cu and better than AN727(Cu for AlN).

Ni plated



Main Peel Mode

	Init	48h	240h	500h	750h	1000h
LF911	A	A	A	A	A	A
AN727	A	A	A	A	A	A

Solder: Pb free (M705)

** peel mode: peeling / fracture at:
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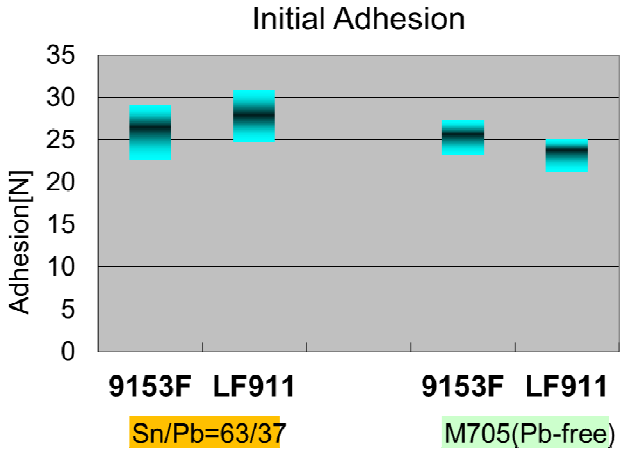
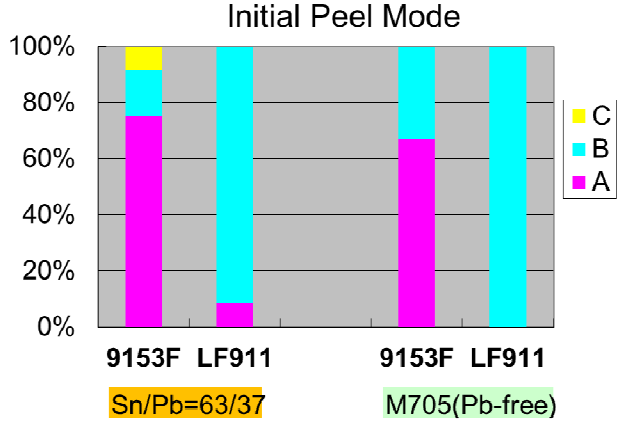
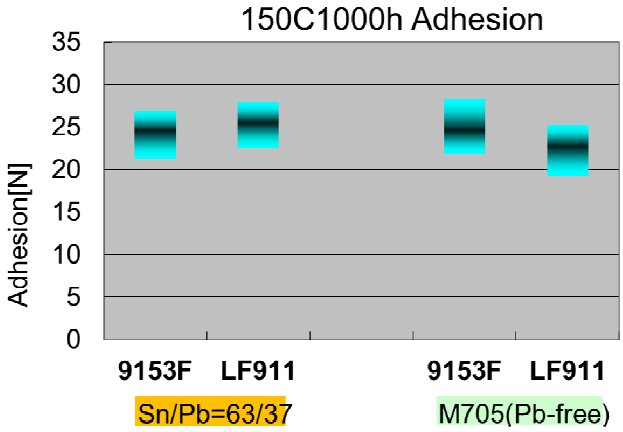
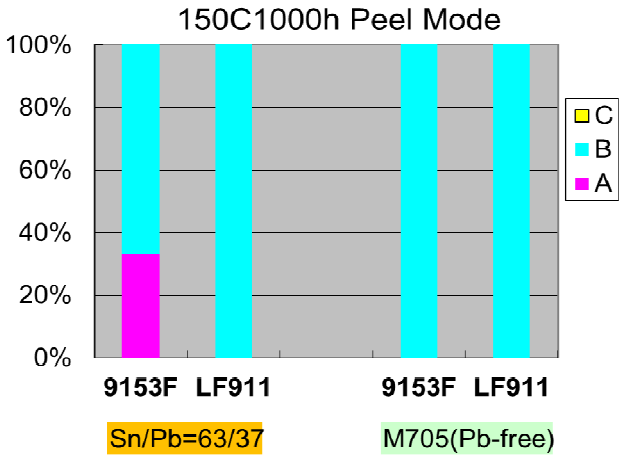
Solder Kinds









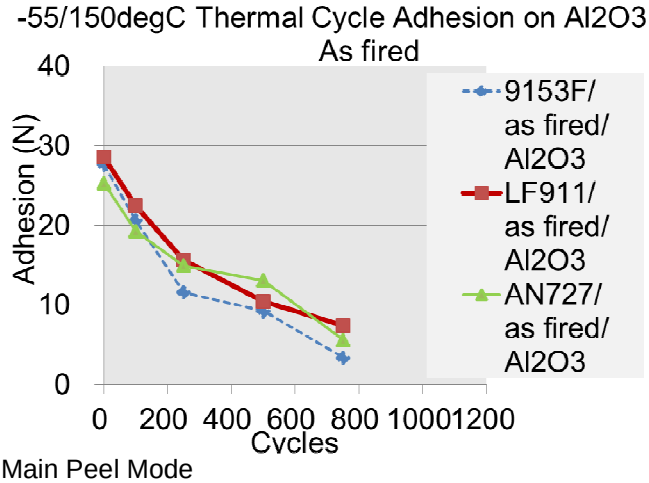
Side by side aged adhesion comparison with 9153F with Pb/Sn and Pb free solder (lead containing Cu) are shown below. Aged adhesion till 1000h showed >20N of adhesion strength with peel mode B (fracture within Cu electrode),

Y. Thermal Cycle Adhesion and Peel Mode (-55⇔150C)

ESPEC CORP. Model : TSA-101S-W

Test condition: +150 deg C /30min, -55 deg C /30min
A solder: M705 (Sn-3.0Ag-0.5Cu : Senju Metal Industry Co., Ltd.), a dip condition: 260 degrees C /10 second

As fired

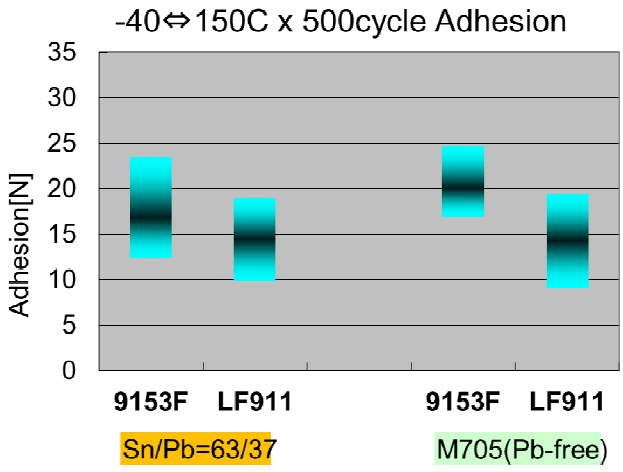


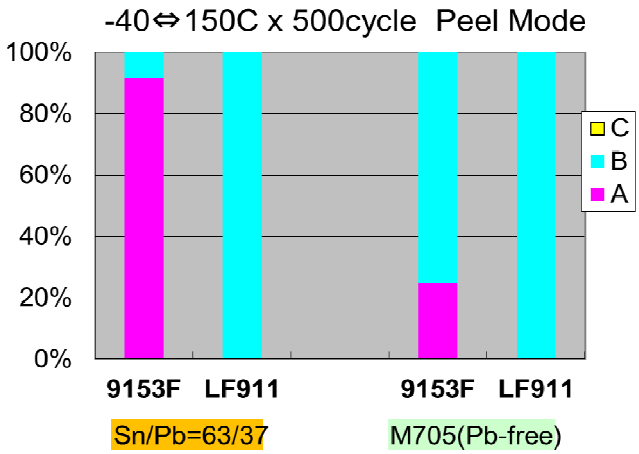
Main Peel Mode

cycles	0	100	250	500	750	1000
9153F	A	B/C	B	C	A/B	
LF911	B	B	B	B	B	
AN727	B	B	B	B	B	

Thermal cycle Adhesion is comparable with 9153F, and decrease over thermal cycles as -55/150C is harsh condition.

Solder Kinds (-40⇔150C)





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