

AL 53-090 Aluminum Conductor

Description: Ferro Corporation offers a full range of thick film inks for contacting the back surface of silicon solar cells.

AL 53-090 Aluminum conductor is specially designed to form a p⁺ doped layer when fired on p-doped silicon photovoltaic devices 200–240 microns thick. When properly processed on 150 mm x 150 mm wafers at 200 micron thickness, the material exhibits < 2.0 mm distortion. The

material has been optimized to eliminate Al bead formation during the firing process. The product is lightly fritted with a leaded but cadmium free glass to provide high adhesion and structural integrity. The product can be fired over a broad range of conditions including co-fire process techniques with front contact silver inks. Combinations of our product offerings can accommodate a variety of configurations and process sequences.

Typical Properties

	AL 53-090
Viscosity (Pa·s) ¹ :	45–65
Fineness of Grind:	< 50 μm
Dried Thickness:	30–40 μm
Fired Thickness:	25–35 μm
Wet Deposition (mg/square cm):	6–8
Bowing (200 micron wafer):	< 2.0 mm
Back Surface Field Thickness:	8–10 μm
Resistivity ² (milliohms/square):	< 15
Drying Profile ³ :	250–300°C, < 60 seconds
Firing ³ :	810–940°C, < 1–3 seconds
Recommended Thinner:	0804

All properties are target values and are not meant to represent product specifications

Notes:

¹Viscosity as measured on Brookfield model HBT cone/plate viscometer; 9.6 reciprocal seconds, 1.565" cone, 25°C.

²Milliohms/sq. at 25μm.

³Recommended set points °C in infrared firing furnace.

Product Advantages:

- RoHS-compliant⁴
- Cadmium Free⁵
- High Adhesion and structural integrity
- Fires through many SiN ARCs

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Processing Recommendations

Printing: It is recommended that the paste temperature be between 20–25°C prior to printing, and it is advisable to control the ambient room temperature within $\pm 2^\circ$ to insure consistent printing results. The printing area should be clean and well-ventilated.

Screen: 200–325 mesh screen with a 10–25 μm emulsion thickness is recommended.

Drying: The ink can be dried in an Infrared or conventional dryer under a wide range of conditions. Inks are typically dried in an IR dryer with set points of 250–300°C in less than 60 seconds.

Firing: An Infrared fast process furnace with three or more firing zones and belt speeds of > 200 inches per minute is highly recommended, although the product may be fired in a variety of furnaces with belt speeds > 120 inches per minute. Optimum firing conditions must be established by the customer based on the cell configuration, thickness, and manufacturing process. Peak set point temperatures between 810–940°C with a dwell time above 700°C ranging from > 1 to 3 seconds is typical.

Compatibility: Ferro has tested this material according to the recommended processing conditions described here, however, it is imperative that customers evaluate the material in their manufacturing process and conditions to insure suitability for their intended use. Ferro technical personnel can help facilitate testing, and can assist with integration into customer manufacturing processes.

Thinning: Thinning is not recommended, since the paste is supplied at the correct viscosity for application. Contact your local Ferro Representative for appropriate solvent details, should thinning become necessary to replace solvent lost through evaporation.

Paste Storage & Shelf Life: The paste should be stored in tightly capped containers in a cool (5–30°C) dry place away from direct sunlight. When properly stored, unopened material will have a shelf life of up to 6 months.

Notes:

⁴Complies with EU Directives on Restriction of the use of Hazardous Substances (RoHS; 2002/95/EC) and Waste from Electrical and Electronic Equipment (WEEE; 2002/96/EC). Current exemptions allow lead contained in the glass system of thick film materials used in electronic components. In anticipation of future amendments and more stringent environmental regulations, Ferro continues to expand its range of Lead Free⁵ materials.

³Initial product composition was certified by SGS laboratories to be below the detection level for cadmium. This conductor paste is not routinely analyzed for cadmium content and is not the basis for product specification or warranty.

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Vista, CA, USA
760-305-1000

Tsukuba, Japan
+81 29-889-2144

Suzhou, China
+86 512-62562258

Hanau, Germany
+49 61-81594739

www.ferro.com

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