

APPLICATION NOTE

InFORCE™29 (107-46-3)

Cu Sinter Paste for Die-Attach

Introduction

InFORCE™29 (107-46-3) is a pressure copper sinter paste developed by Indium Corporation to be sinter-able under nitrogen. This paste is designed for high power die-attach applications where high thermal and electrical conductivity is required. Capable of reliably handling high operating temperatures, this material is suited for die-attach of Si IGBTs, as well as wide bandgap semiconductor devices such as SiC MOSFETs and GaN HEMTs. Four-thousand (4,000) cycles of thermal cycling reliability (-40–175°C) have been completed with high die shear strengths above 40MPa recorded throughout the reliability test.

Storage and Handling

The shelf life of **InFORCE™29** is 6 months when stored at a temperature of -20°C. Allow a minimum of 2 hours for the paste to reach room temperature before use. Actual time to reach thermal equilibrium may vary depending on container size. Some mixing is necessary before use to re-homogenize the paste.

Process Flow

Recommended process flow for die-to-substrate application:



Figure 1. Process Flow Diagram.

Mixing

After thawing, it is normal to observe some separation of the copper and the binder. Re-homogenization should be done using a planetary centrifugal mixer or similar equipment.

For a Thinky planetary mixer, 1.5–2 minutes at 1,000rpm is recommended.

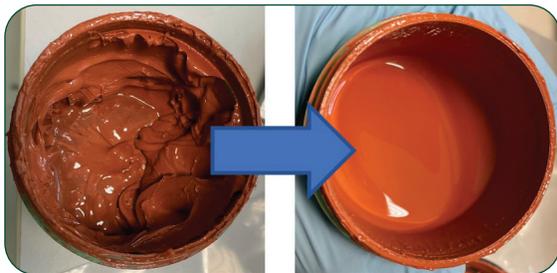


Figure 2. Before and after mixing.

Stencil Printing

Consistent and even print deposits are critical for good coverage and to prevent die crack during die bond and sinter steps.

Recommended Starting Parameters:

- Print speed: 20–30mm/s
- Print pressure: Depending on squeegee length, 4–5kg (30cm blade); increase pressure if excessive paste remains on the stencil
- Separation speed: 1–2mm/s. Slower separation speed helps to mitigate “dog ear” defects

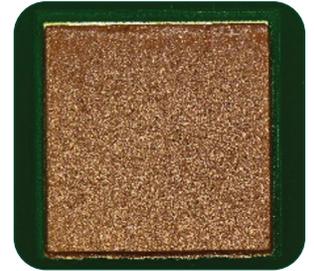


Figure 3. Printed paste deposit.

Pre-Dry

Pre-dry should be optimized for sufficient solvent evaporation. Inadequate drying times will result in paste squeeze-out and drying channels post-sintering. Oxygen levels should be below 5,000ppm during drying. Dry for 10–15 minutes at 100°C. Ramp rate is not critical; hotplates or ovens can be used.

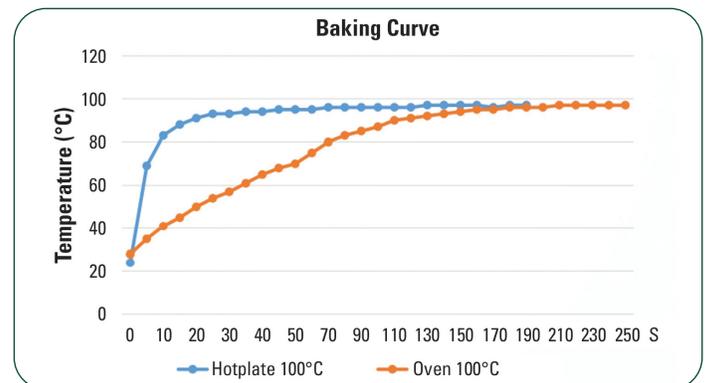


Figure 4. Typical pre-dry curves.

From One Engineer To Another®



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Die Bond

Hot die placement is necessary on the pre-dried sinter paste. Process time will depend on equipment capability to reach the process setpoints.

- Bond force: 5kg
- Temperature: 110°C

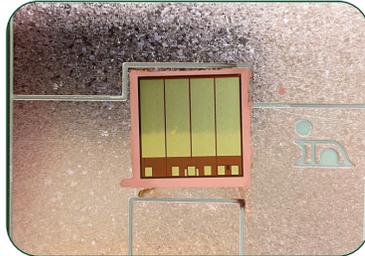


Figure 5. Die bonded on AMB substrate.

Pressure Sinter

Uniform temperature and pressure are critical to ensure consistent, good quality bonds. Oxygen content during the sinter step should be <1,000ppm.

Recommended Sinter Processes Parameters:

- Sinter pressure: 15–20MPa
- Sinter temperature: 250°C
- Sinter time: 5–10 minutes

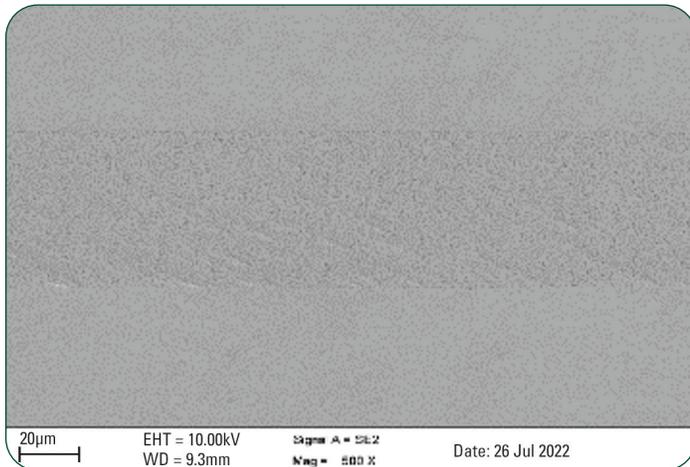


Figure 6. Cross-section after sintering.

BLT Post-Sintering

Due to the InFORCE™ 29 high metal load formulation, the reduction in bondline thickness from wet paste to post-sinter is approximately 40–50%.

Post-Sinter Properties

InFORCE™ 29 Properties	
Melting Point (°C)	1,084
Electrical Resistivity ($\mu\Omega\cdot\text{cm}$)	5.9
Thermal Conductivity (W/mK)	>140
CTE (ppm/K)	16

Summary

InFORCE™ 29 is a pressure copper sinter paste targeted for high power die-attach applications. For best results, the recommended process parameters should be used as a starting point and adjusted where necessary. Indium Corporation's experienced applications and technical support team are on hand to offer any guidance that is needed.

This application note is provided for general information only. It is not intended, and shall not be construed, to warrant or guarantee the performance of the products described which are sold subject exclusively to written warranties and limitations thereon included in product packaging and invoices. All Indium Corporation's products and solutions are designed to be commercially available unless specifically stated otherwise.

All of Indium Corporation's solder paste and preform manufacturing facilities are IATF 16949:2016 certified. Indium Corporation is an ISO 9001:2015 registered company.

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