

# PRODUCT DATA SHEET

# WS-829

## Halogen-Free Ball-Attach and LED Die-Attach Flux

### Introduction

**Ball-Attach Flux WS-829** is a halogen-free water-soluble ball-attach and LED die-attach flux designed for use in pin transfer and printing applications for ball-attachment to substrates (BGA manufacturing) and wafer/panel (WLP/PLP manufacturing). **WS-829** can also be used for LED die-attach application. Its thixotropic property allows it to be printed on a substrate consistently with superb print definition for very small deposit without slumping. Its rheology is specifically designed for use with even the smallest gravity-fed spheres. **WS-829** has an activator system powerful enough to promote wetting on the most demanding substrate metallizations. Flux residue of **WS-829** can be effectively cleaned with just DI water only without leaving any contamination behind.

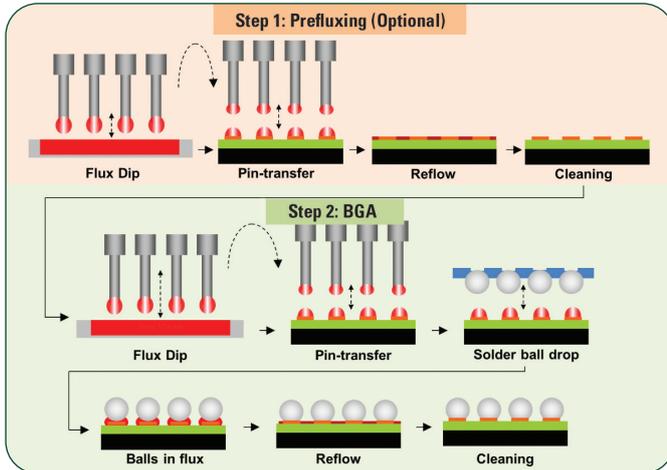


### Features

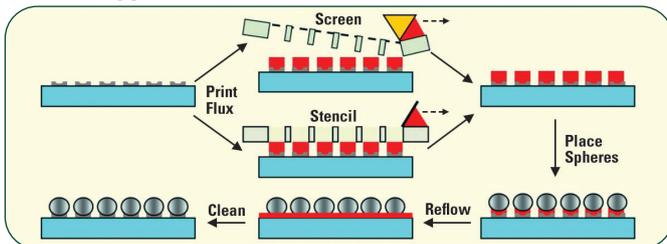
- Designed for ball-attach process, pin transfer, and printing applications
- Also suitable for miniLED or microLED die-attach application, printing through stencil for ultrafine aperture
- Halogen-free—per IPC and IEC specifications
- Flux rheology suitable even for smallest sphere size
- Thixotropic property ensures good print definition with minimal slump
- Promotes excellent solderability and wetting on a wide range of surfaces
  - Good results on AuNi and even on oxidized Cu-OSP (up to 0.3mm thick OSP)
- Promotes strong, low-voiding joints
- Cleans well with room temperature DI water
  - Saves money on water heating
  - No undesirable flux residue or contamination
- Designed for Pb-free applications
  - Suitable for all high-tin solders
- Ensures consistent joint quality by providing consistent pin transfer and printing performance over extended periods
- Reduces “double ball” and “missing balls”
  - Maintains tackiness during heating, results in minimal sphere movement
- Reflows in air or nitrogen
- Stable at room temperature for up to 6 months

### Standard Ball-Attach Process

#### Pin Transfer Application



#### Printing Application



### Flux Properties

Industry Standard Test Results and Classification	
Flux Classification	ORH0
Based on the testing required by IPC J-STD-004A.	
Halogen-free per IEC 61249-2-21, Test Method EN14582	<900 ppm Cl <900 ppm Br <1,500ppm Total

	Value	Test Method
Typical Viscosity	18kcps (5 minutes)	Brookfield HB DVII±CP (5rpm)
Typical Acid Number	84mg KOH/g	Titration
Typical Tack Strength	300g	J-STD-005 (IPC-TM-650: 2.4.44)
Shelf Life	0–30°C for 6 months	Viscosity change/microscope examination

All information is for reference only.  
Not to be used as incoming product specifications.

From One Engineer To Another®



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## Pin Transfer

### Viscosity Test Method

- **Equipment**
  - Brookfield Cone & Plate
  - Model: DV3THBCB
- **Parameters**
  - Spindle: CP-51
  - Temperature: 25°C
  - Rpm: 10rpm



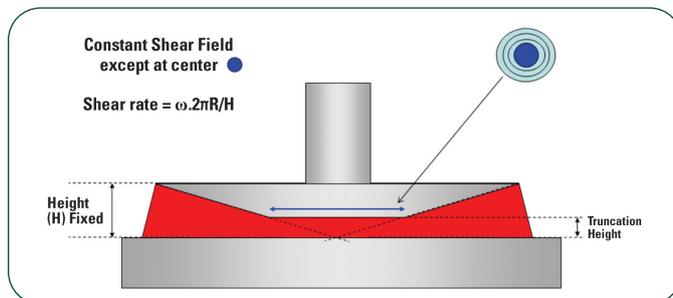
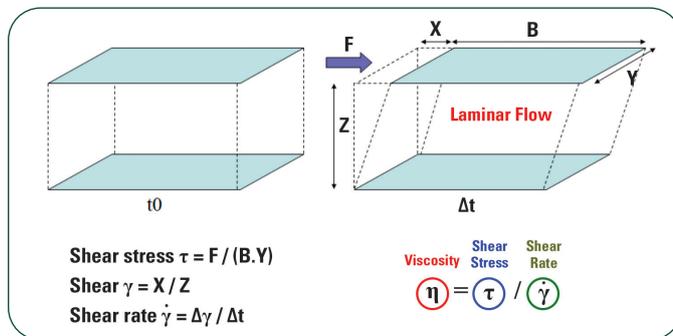
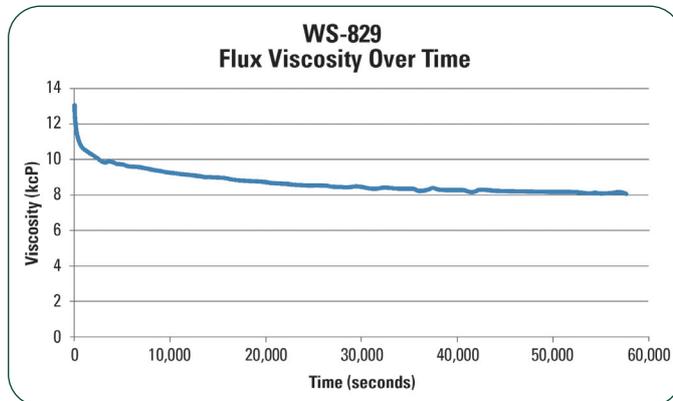
### Tack Test Method

- **Equipment**
  - Texture Technologies TA.XT2
- **Parameters**
  - Ambient Conditions
  - Humidity: 50% ± 3%
  - Room Temperature: 21.5°C ± 2°C

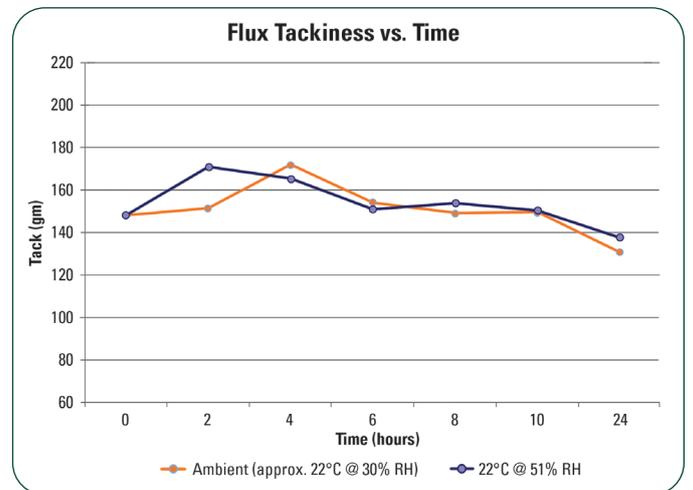


## Viscosity as a Function of Time

### Viscosity Controls



## Tack as a Function of Time



## Consistent Flux Deposition

WS-829's consistent viscosity and tack ensures consistent flux deposit sizes and eliminates missing ball before reflow.



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## Printing



### Printing Response-to-Pause (RTP) Test Method

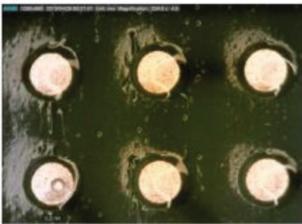
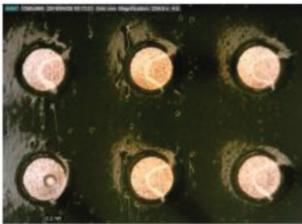
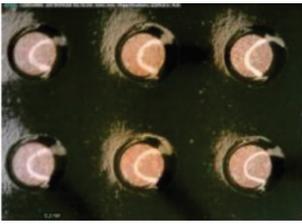
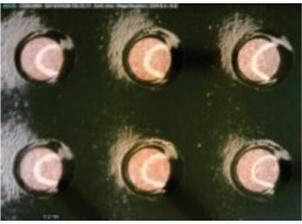
1. Knead 30 cycles @ 50mm/sec
  - a. Print one test board (0 hours)
  - b. Run a wet/dry/vac understencil wipe and pause for 1 hour
2. Knead 80 cycles @ 50mm/sec
  - a. Print one test board (1 hour)
  - b. Run a wet/dry/vac understencil wipe and pause for 1 hour
3. Repeat Step 2 another 3 times for printing test board at 2, 3, and 4 hours

### Consistent Printing Performance

Consistent printing performance over extended periods ensures good joint quality.

## Slump Test

- Inspect test boards from above test every 30 minutes for up to 2 hours

Results			
(Pictures at different time intervals are selected since all show minimal variation)			
	Initial Flux Printed	60-Minute Flux Printed	120-Minute Flux Printed
0 Hours			
2 Hours			
4 Hours			

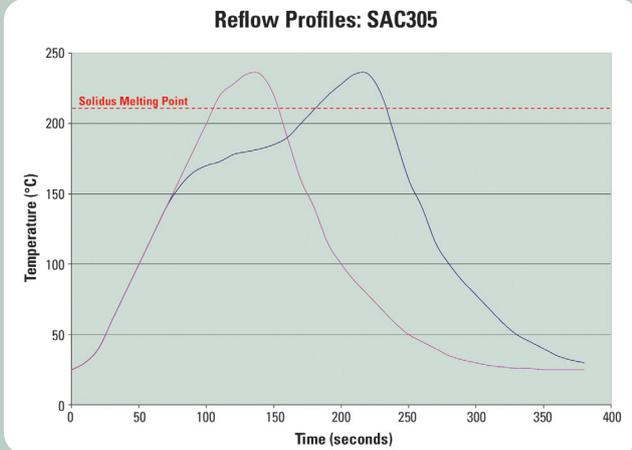
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## Reflow

### Reflow

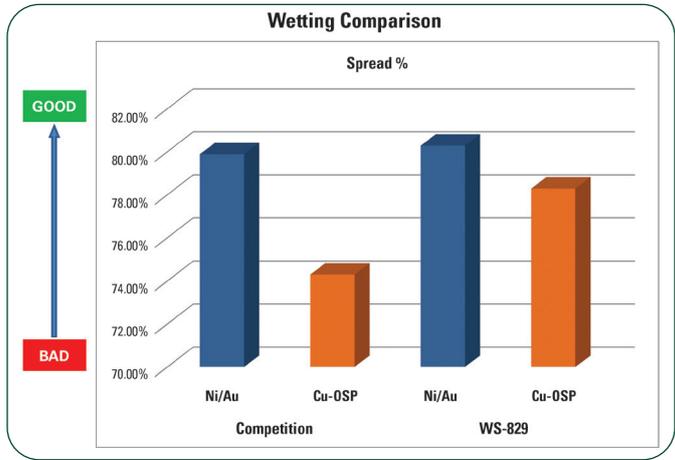
Recommended Profile:



WS-829 is suitable for air and nitrogen reflow, and can work well in a variety of reflow profiles.

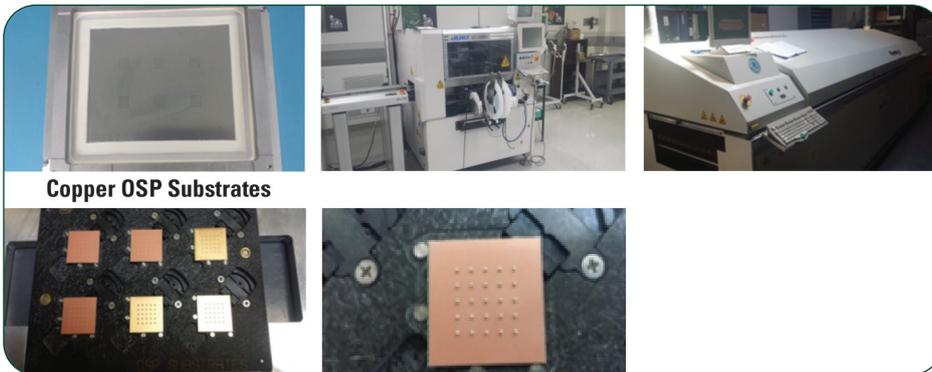
$$S_R = \frac{D-H}{D} \times 100 \dots\dots\dots (16)$$

- where,  $S_R$ : spreading ratio (%)  
 $H$ : height of the spread solder (mm)  
 $D$ : diameter of the solder, when it is assumed to be a sphere (mm)  
 $D = 1.24V^{1/3}$   
 $V$ : mass (12)/density of tested solder



## Eliminates Missing Ball and Increases Joint Strength

WS-829 eliminates missing ball during reflow by high viscosity and rapid soldering. Joint strength is high due to good wetting.



### Solderability Test Method

- Print flux onto metallized surface
- Place spheres onto flux deposit
- Reflow (air or N<sub>2</sub> [typical])
- Measure reflowed height deposit
- Calculate spreading ratio (wetting)



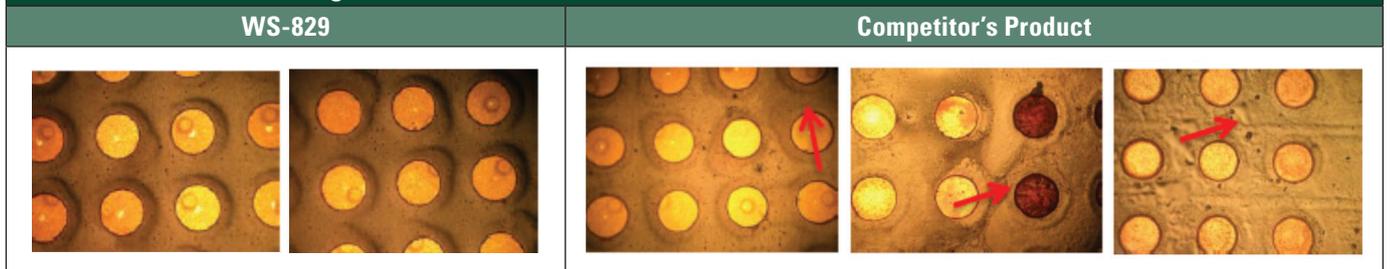
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# WS-829 Halogen-Free Ball-Attach and LED Die-Attach Flux Cleaning

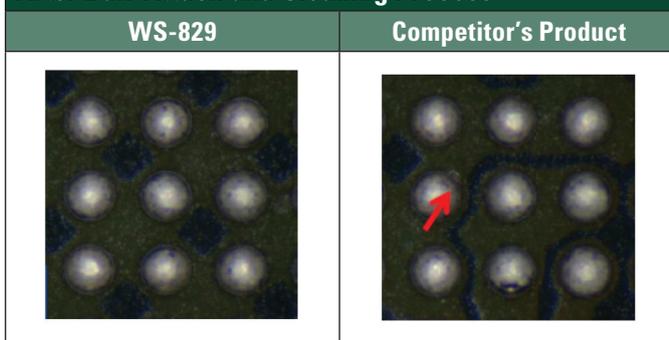
### Cleaning Process

Using in-line DI water spray cleaning equipment

#### After Cu-OSP Pre-Cleaning Process



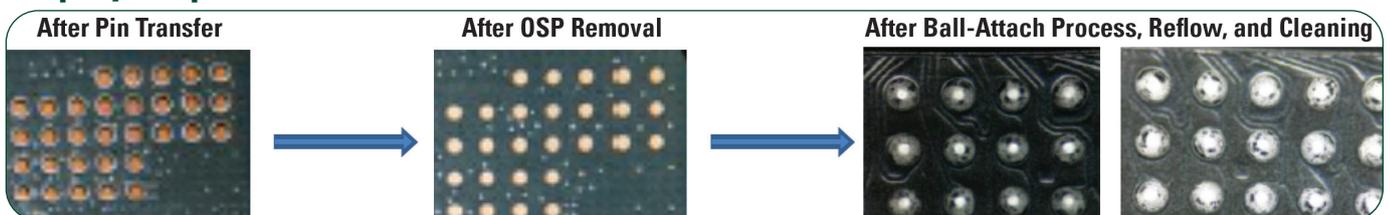
#### After Ball-Attach and Cleaning Process



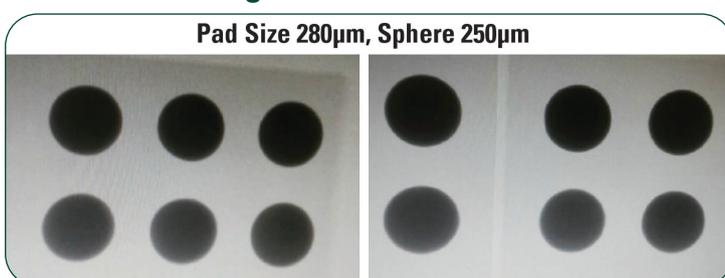
### Best-in-Class Cleanability

**WS-829** was able to remove Cu-OSP and most stubborn contamination on the substrate, and residue was easily removable with standard cleaning process.

### Step-by-Step Process



### Minimal Voiding



Contact our engineers: [askus@indium.com](mailto:askus@indium.com)

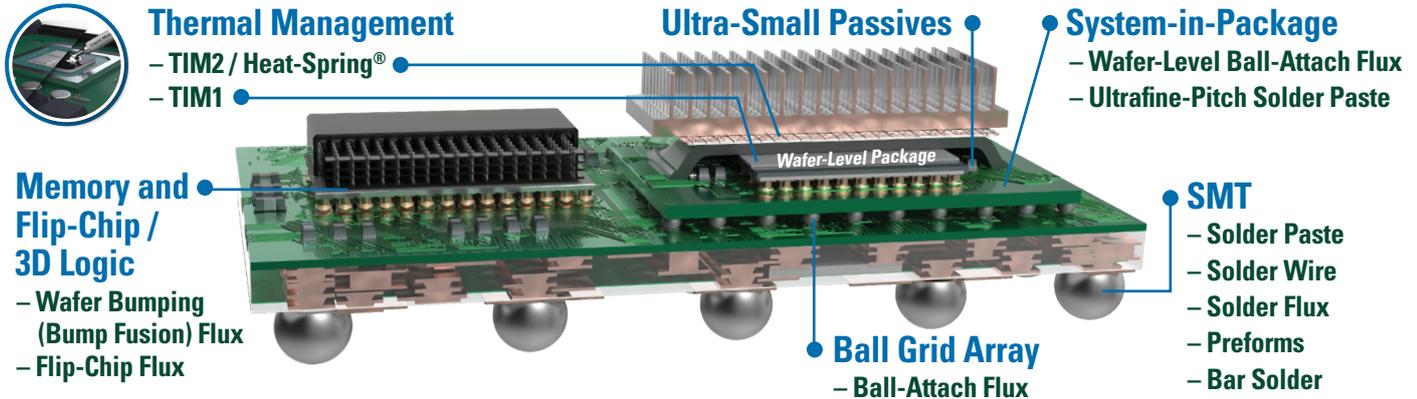
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# WS-829 Halogen-Free Ball-Attach and LED Die-Attach Flux

## Heterogeneous Integration & Assembly Materials



## Recommended Semiconductor Fluxes and Solder Pastes

Material Group	Material Type	Material Name	Flux Type	Halogen-Free	Application	Comments
FLUX	Wafer Bumping Flux	SC-5R	Solvent-clean	Yes	Spin coating	High Pb, Sn/Pb Eutectic and SnAg solder bumps
		WS-3543	Water-wash	Yes	Spin coating	High viscosity for taller copper-pillars and larger bumps (>40 microns)
		WS-3401	Water-wash	Yes	Spin coating	Low viscosity for smaller pillars and bumps
	Wafer-Level or Panel-Level Packaging Flux	WS-676	Water-wash	Yes	Printing	0.5mm and smaller pitch wafer-level or panel level package
		WS-759				
		WS-829				
	Flip-Chip Flux	WS-575-SP	Water-wash	Yes	Jetting/Spraying	Sn/Pb Eutectic and SnAg onto SOP for logic flip-chip
		FC-NC-HT-A1	No-clean	Yes	Jetting/Spraying	Mass reflow flux compatible with CUF
		WS-446	Water-wash	No	Dipping	Best flux for poor solderability
		WS-688	Water-wash	Yes	Dipping	General purpose for multi-core logic flip-chip
		WS-641	Water-wash	Yes	Dipping	For chip-on-wafer, high-density Cu-pillar application
		NC-26-A	Ultra-low residue no-clean	Yes	Dipping	Best compatibility with CUF/MUF
		NC-26S	Ultra-low residue no-clean	Yes	Dipping	Avoids capillary flow up to die surface for fine-pitch devices
	Ball-Attach Flux	NC-699	Near-zero residue	Yes	Dipping	Controlled solderability, compatible with wide variety of CUF/MUF
		WS-446-AL	Water-wash	No	Pin Transfer	Best flux for poor solderability
		WS-823	Water-wash	Yes	Pin Transfer	Best all-around halogen-free ball-attach flux, easily cleaned
		WS-829	Water-wash	Yes	Printing and pin transfer	For sphere size <0.25mm and fine-pitch high-density ball-attach, best cleanability
		NC-585	No-clean	Compliant	Pin Transfer	Good wetting onto bare nickel for 0.5mm pitch or lower BGA/PGA
Flip-Chip and Ball-Attach Flux	WS-575-C-RT	Water-wash	NIA	Pin Transfer	Best ball-attach flux for missing ball Eliminates the prefluxing step for OSP	
	NC-809	Ultra-low residue no-clean	Yes	Dipping	Enhanced wetting, compatible with wide variety of CUF/MUF	
				Printing and pin transfer	Suitable for no-clean process, good wetting onto gold surface	
WS-446HF	Water-wash	Yes	Dipping	Best all-around halogen-free flip-chip flux, easily cleaned		
			Pin Transfer	Suitable for one-step Cu OSP process for sphere size 0.25mm and above		
SOLDER PASTE	Jetting Paste	PicoShot® WS-5M	Water-wash	Yes	Jetting	For dot jetting of 300µm diameter and above, and fine-line dispensing for metal lid-attach
		PicoShot® NC-5M	Solvent- or aqueous-based chemistry or no-clean	Yes	Jetting	For dot jetting of 300µm diameter and above, and fine-line dispensing for metal lid-attach
					Jetting and Microdispensing	For dot jetting down to 80µm diameter and above, and fine-line dispensing for metal lid-attach
	SiPaste® Solder Paste	SiPaste® 3.2HF	Water-wash	Yes	Printing	Type 6, Type 7, and Type 8 solder paste suitable for ultrafine-pitch printing
		SiPaste® C201HF	DI water + saponifier or semi-aqueous chemistry			
SiPaste® SMQ77	No-clean					
OTHER	Adhesive Solution	NC-702	Minimal to no residue	Yes	Dipping/Dispensing/Jetting	Holding die, chip, and preform in place, for formic acid reflow

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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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