

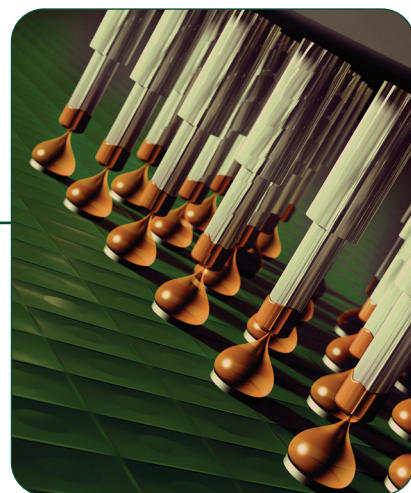
## PRODUCT DATA SHEET

# WS-823

## Halogen-Free Ball-Attach Flux

### Introduction

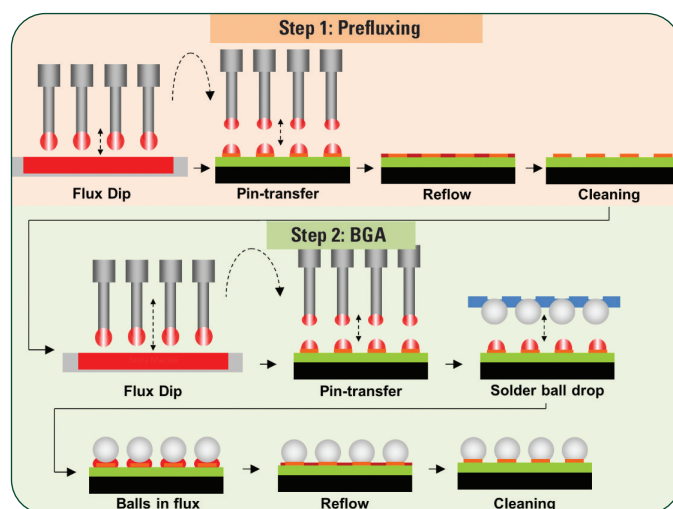
Indium Corporation's **Ball-Attach Flux WS-823** allows customers to use a halogen-free (NIA = no intentionally added halogens) single-step ball-attach process to eliminate the costly, wasteful, and warpage-inducing effects of prefluxing. The "Standard Ball-Attach Process" diagram shows the typical two-step flux processing that is needed to create reliable, ball-to-pad joints from final BGA balling. The prefluxing step can only be eliminated if the flux has sufficient activity to overcome the extent of the oxidation on copper, and create strong solder joints. **WS-823** is customer-proven to be able to eliminate the need for multiple fluxing steps before final ball-attach.



### Features

- **Halogen-free** – no intentionally added (NIA) halogens
- **Eliminates process costs and warpage due to "prefluxing"**
  - No extra fluxing, reflow, cleaning, and substrate warpage (see right)
- **Reflows in air or nitrogen**
  - Can eliminate the cost of nitrogen
- **No "missing ball"**
  - Tack during heating and fast soldering ensure balls stay in place during reflow
- **Excellent solderability on a wide range of surfaces**
  - Good results on AuNi and even on oxidized Cu OSP (up to 0.3mm thick OSP)
- **Uniform pin transfer over extended periods**
  - Avoids changes of joint quality over time and uneven deposit sizes, which can lead to "missing ball"
- **Low-voiding**
  - Increases joint strength
- **Designed for Pb-free applications**
  - Suitable for all high-tin solders: SAC105, SAC305, SAC385, SAC405
- **Cleanable with room temperature DI water only**
  - Saves money on water heating
- **No "white residue"**
  - Cleaning the flux residues at lower temperatures avoids the formation of white residues
- **Stable at room temperature**
  - Ease of storage and use without crystals or gel balls
  - Ready to use, straight from the jar or cartridge

### Standard Ball-Attach Process



### Flux Properties

Industry Standard Test Results and Classification	
Flux Classification	ORH0*
Based on the testing required by IPC J-standard-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	90mg KOH/g	Titration
Typical Tack Strength	175g	J-STD-005 (IPC-TM-650: 2.4.44)
Shelf Life	0–30°C for 1 year	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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# WS-823 Halogen-Free Ball-Attach Flux

## Pin Transfer

### Viscosity Test Method

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



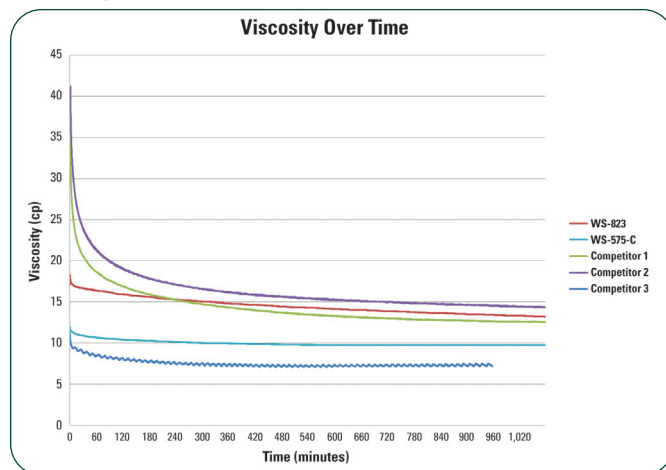
### Tack Test Method

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

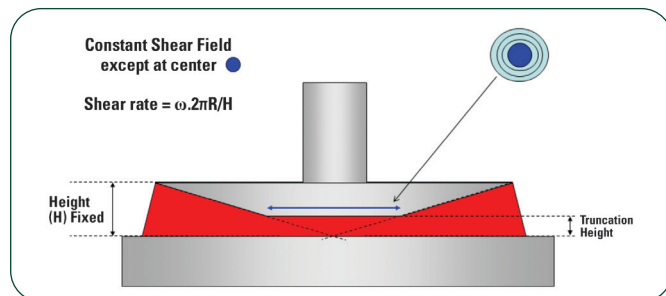
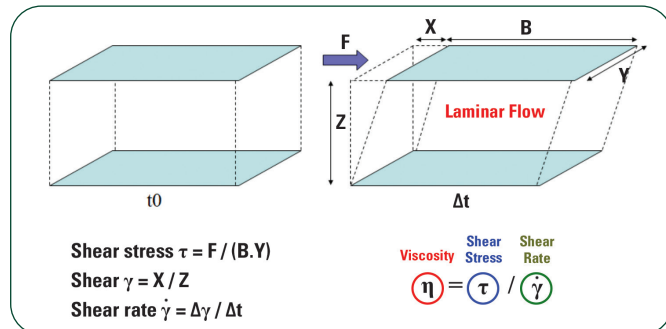
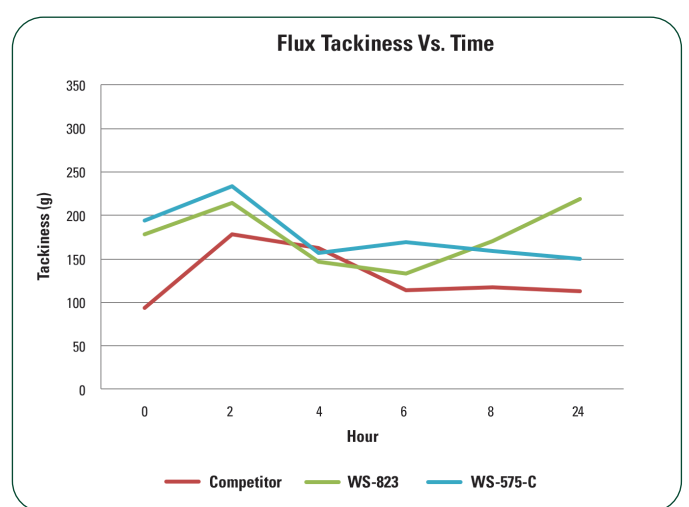


## Viscosity as a Function of Time

### Viscosity Controls



## Tack as a Function of Time



## Consistent Flux Deposition

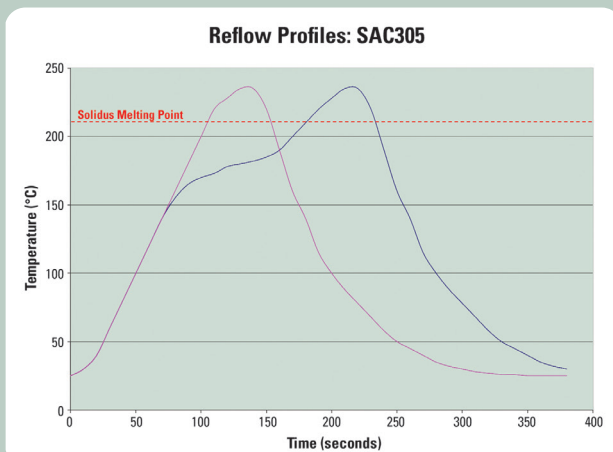
WS-823's consistent viscosity and tack ensure consistent flux deposit sizes and eliminate missing ball before reflow.

# WS-823 Halogen-Free Ball-Attach Flux

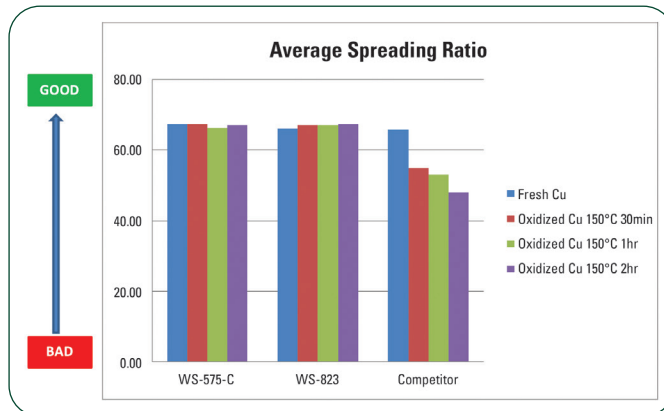
## Reflow

### Reflow

#### Recommended Profile:



WS-823 is suitable for air and nitrogen reflow, and can work well in a variety of reflow profiles.



## Eliminate Missing Ball and Increase Joint Strength

WS-823 eliminates missing ball during reflow by high viscosity and rapid soldering. Joint strength is high due to good wetting.

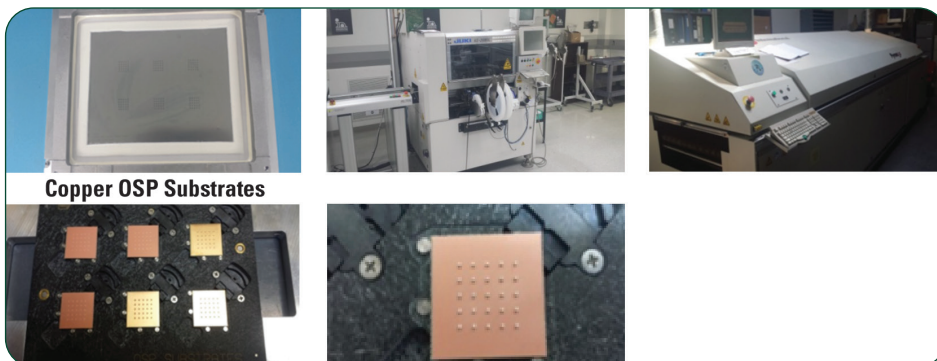
## Eliminate Extra Costs and Warpage

For flip-chip BGA, bottom pads can become extremely oxidized. **WS-823** eliminates the need for a prefluxing step, which:

- Reduces process cost
- Reduces package warpage
- Increases UPH

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

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 (g)/density of tested solder



## Solderability Test Method

- Print flux onto metallized surface
- Place spheres onto flux deposit
- Reflow (air or  $N_2$  [typical])
- Measure reflowed height deposit
- Calculate spreading ratio (wetting)

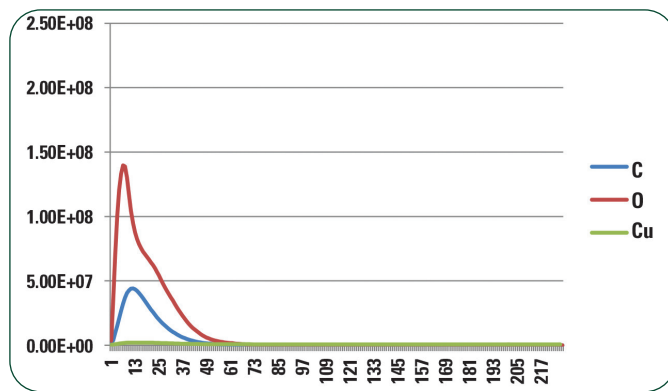
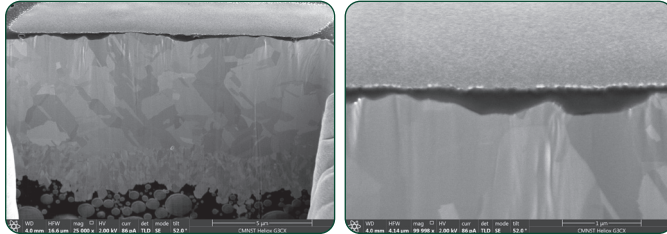
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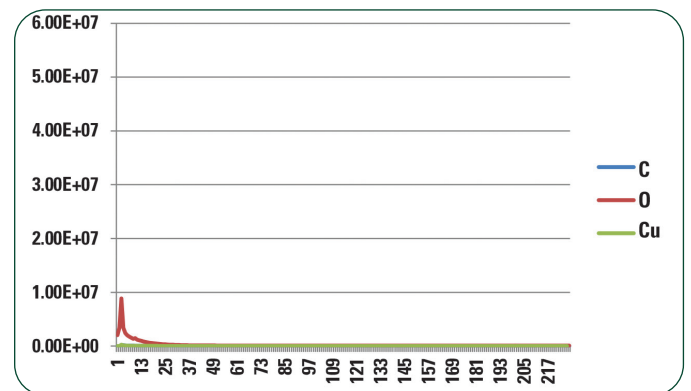
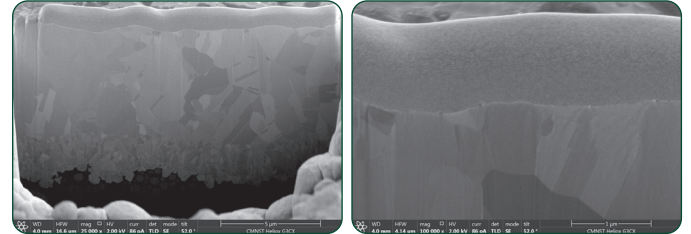
## Cleaning

### FIB (Focused Ion Beam) and SIMS (Secondary Ion Mass Spectrometry) Analysis on Cu OSP Substrate

Fresh Cu OSP Substrate



Cu OSP Substrate after WS-823 Flux Clean

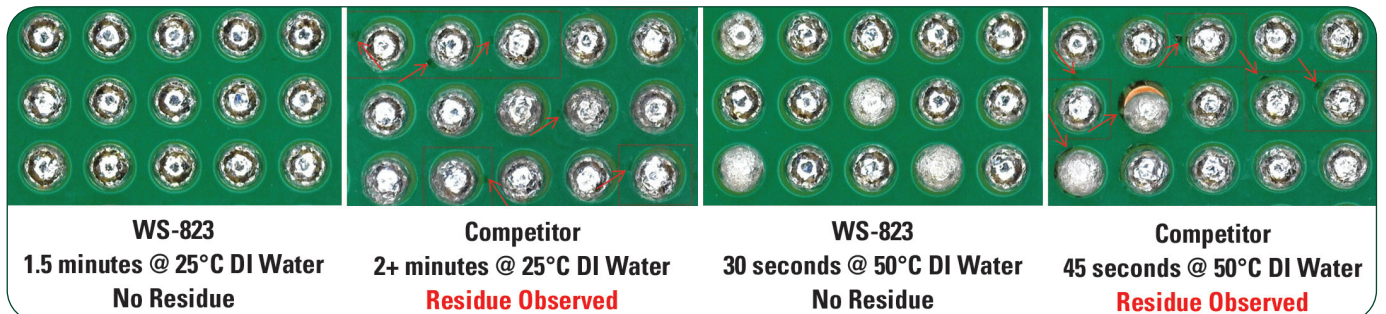


## Cleaning Test

- **Very mild (forcing) condition**
  - Deionized water
  - Deionized water conductivity  $\leq 1.00\mu\text{S/cm}$
  - Zero pressure
  - Flow rate 5cc/minute

## Simplified, Low-Cost Cleaning

**WS-823** is cleanable with room temperature deionized (DI) water only, eliminating chemical cleaning costs and costs of heating water.



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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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