

PRODUCT DATA SHEET

WS-823

Halogen-Free Ball-Attach Flux



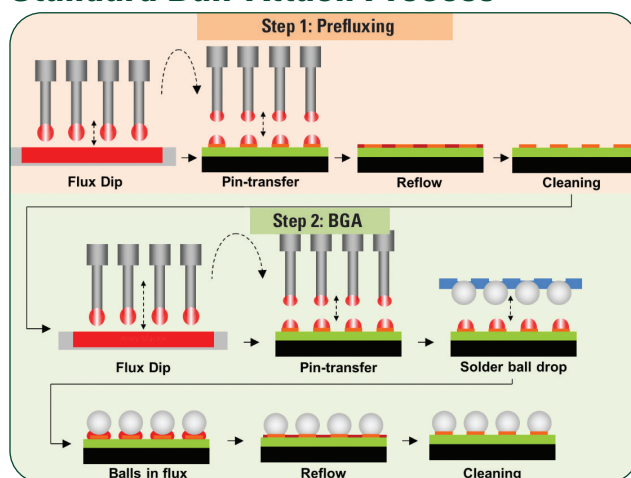
Introduction

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®



Form No. 99552 R3

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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

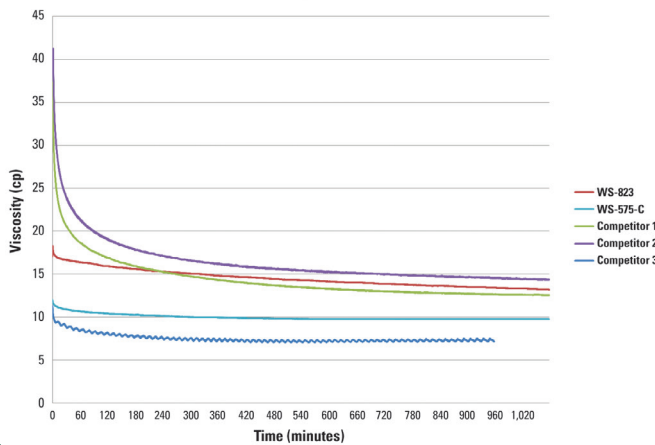
- **Equipment**
 - Texture Technologies TA.XT2
- **Parameters**
 - Ambient Conditions
 - Humidity: 50% ± 3%
 - Room Temperature: 21.5°C ± 2°C



Viscosity as a Function of Time

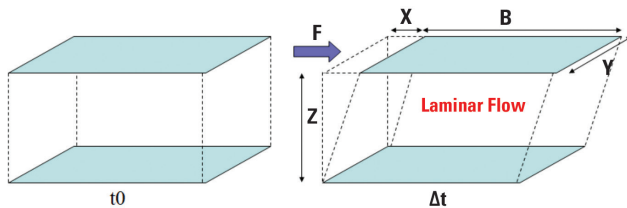
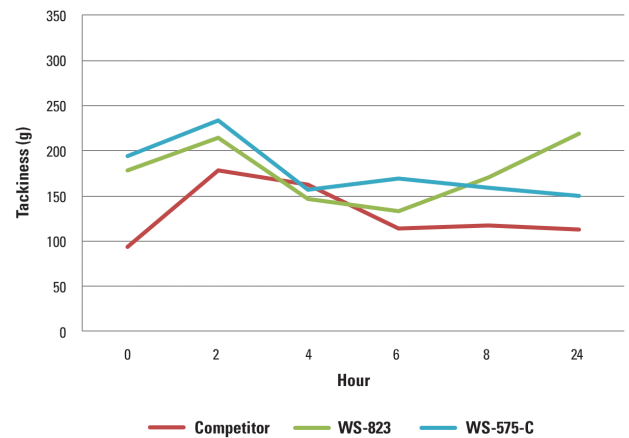
Viscosity Controls

Viscosity Over Time



Tack as a Function of Time

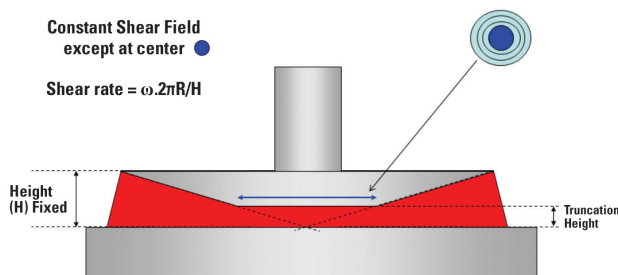
Flux Tackiness Vs. Time



Shear stress $\tau = F / (B \cdot Y)$
 Shear $\gamma = X / Z$
 Shear rate $\dot{\gamma} = \Delta\gamma / \Delta t$

Viscosity $\eta = \tau / \dot{\gamma}$

Constant Shear Field
 except at center ●
 Shear rate $= \omega \cdot 2\pi R / H$



Consistent Flux Deposition

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

Contact our engineers: askus@indium.com

Learn more: www.indium.com

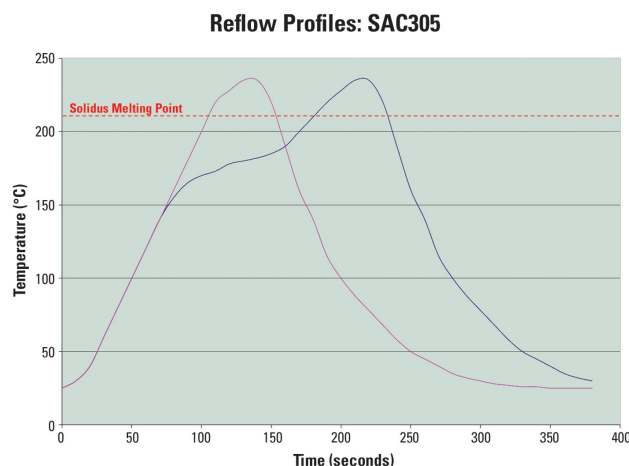


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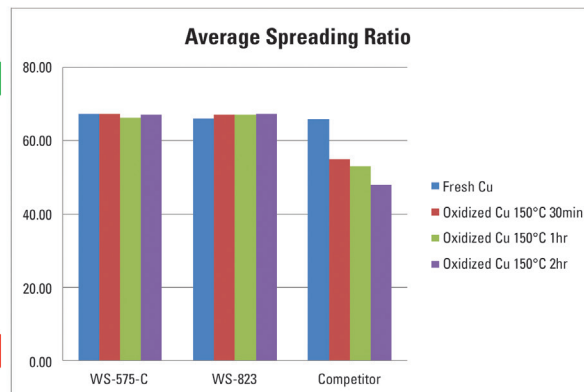
Reflow

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

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

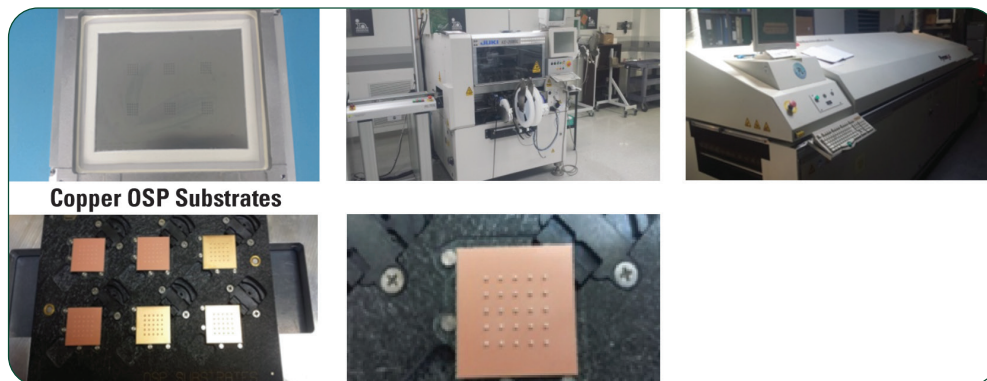
where, S_R : spreading ratio (%)

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 (12)/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)



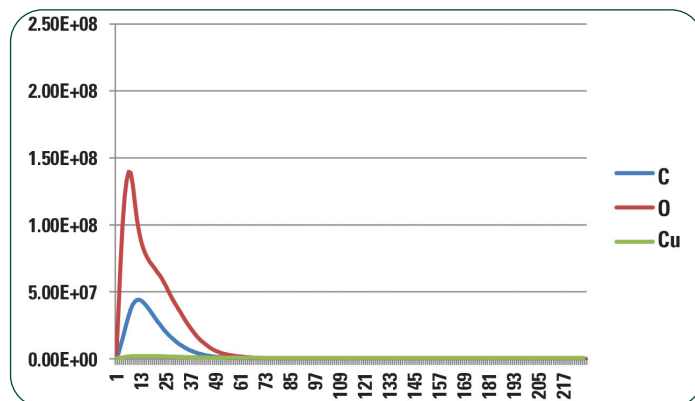
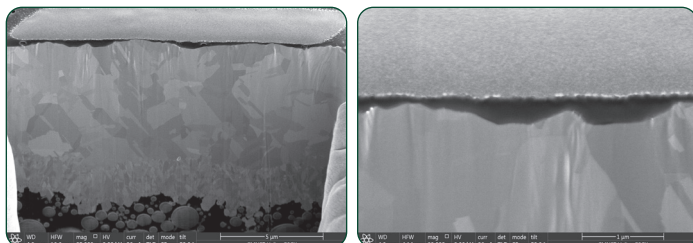
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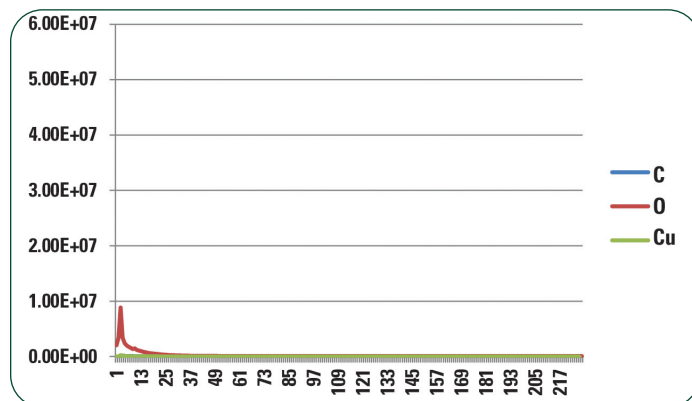
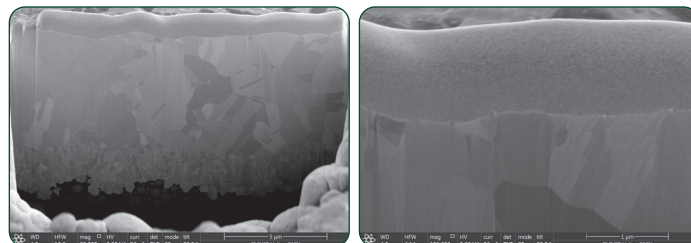
Cleaning

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

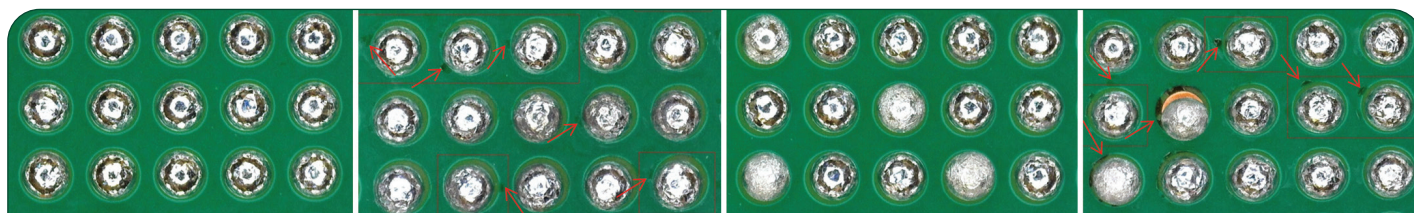


Cleaning Test

- **Very mild (forcing) condition**
 - Deionized water
 - Deionized water conductivity $\leq 1.00 \mu\text{S}/\text{cm}$
 - 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.



WS-823
1.5 minutes @ 25°C DI Water
No Residue

Competitor
2+ minutes @ 25°C DI Water
Residue Observed

WS-823
30 seconds @ 50°C DI Water
No Residue

Competitor
45 seconds @ 50°C DI Water
Residue Observed

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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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