

PRODUCT DATA SHEET

WS-575-C-RT

Halogen-Free Ball-Attach Flux



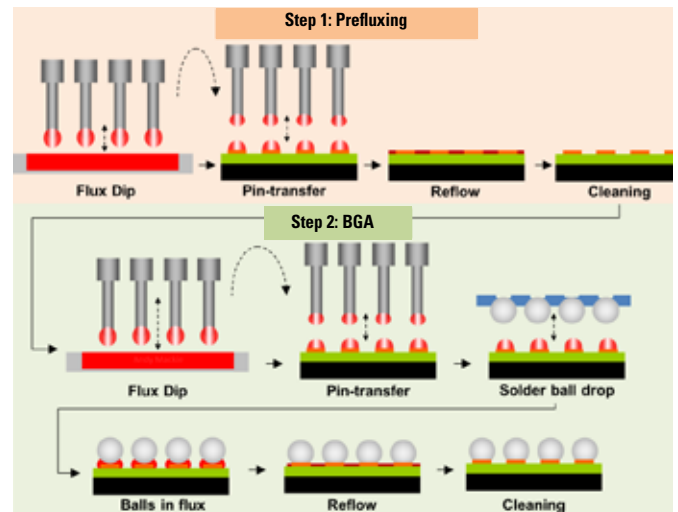
Introduction

Indium Corporation's **Ball-Attach Flux WS-575-C-RT** allows customers to use a completely 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-575-C-RT** 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**
 - NIA means that the flux is formulated to be free of 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, SAC38, 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

| Property | Value | Test Method |
|----------------------------|--|---|
| Flux Type Classification | ORH0 | J-STD-004 (IPC-TM-650: 2.3.32 and 2.3.33) |
| Typical Viscosity | 20kcps (5mins) | Brookfield HB DVII +-CP (5rpm) |
| SIR (Ohms, after cleaning) | Pass (>10 ⁸ after 7 days @ 85°C & 85% RH) | J-STD-004 (IPC-TM-650: 2.6.33 IPC-B-24) |
| Typical Acid Number | 95mg KOH/g | Titration |
| Typical Tack Strength | 360g | 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 and Plate
 - Model: DV3THBCB
- **Parameters**
 - Spindle: CP-51
 - Temperature: 25°C
 - RPMs: 20RPM



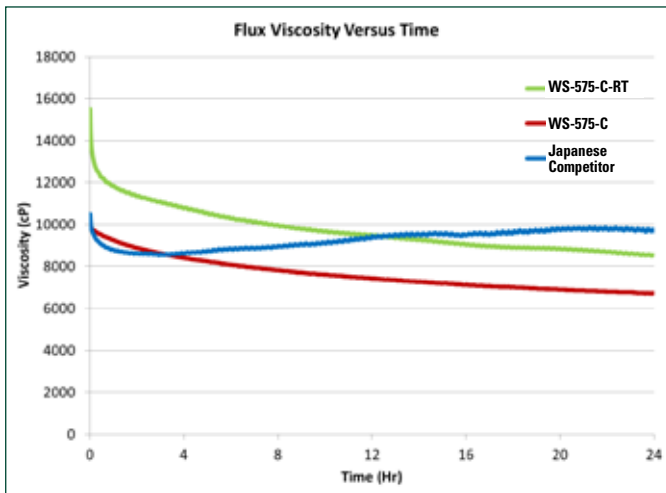
Tack Test Method

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

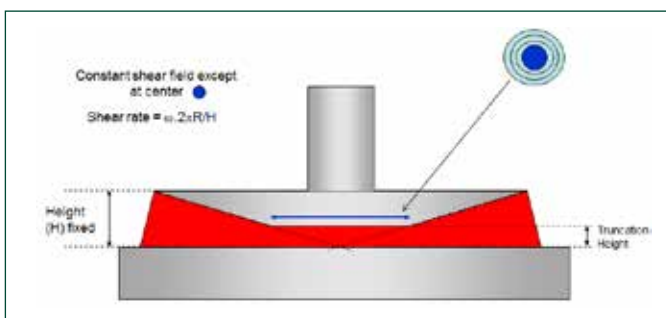
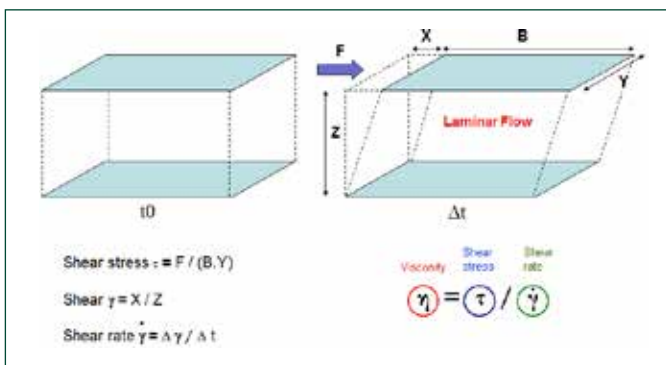
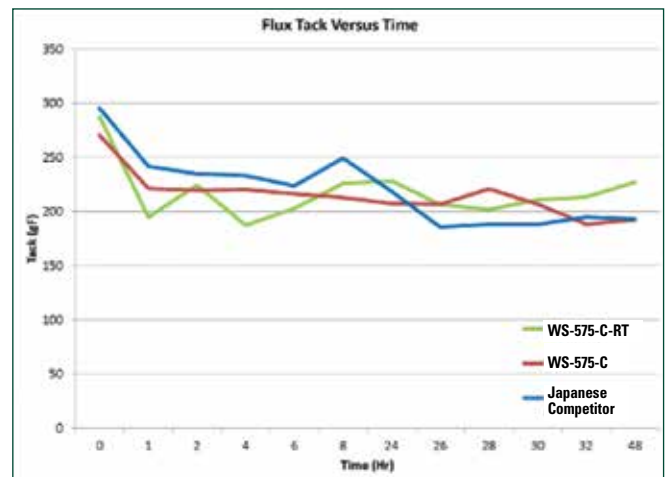


Comparative Viscosities as a Function of Time

Viscosity Controls



Tack as a Function of Time



Consistent Flux Deposition

WS-575-C-RT's consistent viscosity and tack ensure consistent flux deposit sizes and eliminate missing ball before reflow.

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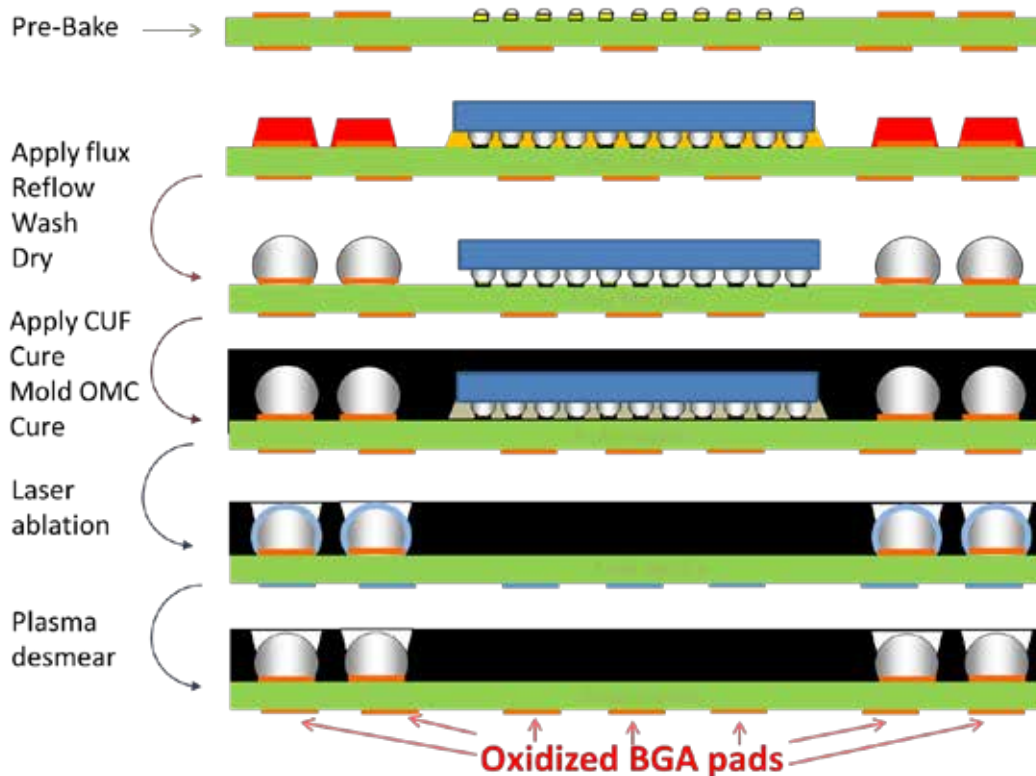
Learn more: www.indium.com



Ball-Attach Flux WS-575-C-RT

Reflow

OSP Degradation From FCBGA Substrate Treatment Before BGA Balling



Test Materials and Reflow

- **Solder Spheres**
 - SAC305, 28mil
 - 7-hour bake @ 130°C
- **Reflow**
 - Soak (preheat) reflow profile
 - Air reflow
- **Substrates**
 - OSP substrates

Simulated Preconditioning

- **None**
- **Bake**
 - 2-hour bake @ 170°C
 - 7-hour bake @ 130°C
- **Bake and Cleaner**
 - 2-hour bake @ 170°C
 - Cleaned with aggressive aqueous flux cleaner @ 96°C
 - 7-hour bake @ 130°C
- **Double Bake and Cleaner**
 - 2-hour bake @ 170°C
 - Cleaned with aggressive aqueous flux cleaner @ 96°C
 - 7-hour bake @ 130°C
 - 2-hour bake @ 170°C
 - Cleaned with aggressive aqueous flux cleaner @ 96°C
 - 7-hour bake @ 130°C

Eliminate Extra Costs and Warp

For flip-chip BGA, bottom pads can become extremely oxidized.

WS-575-C-RT eliminates the need for a prefluxing step, which reduces:

- Process cost
- Package warpage
- UPH

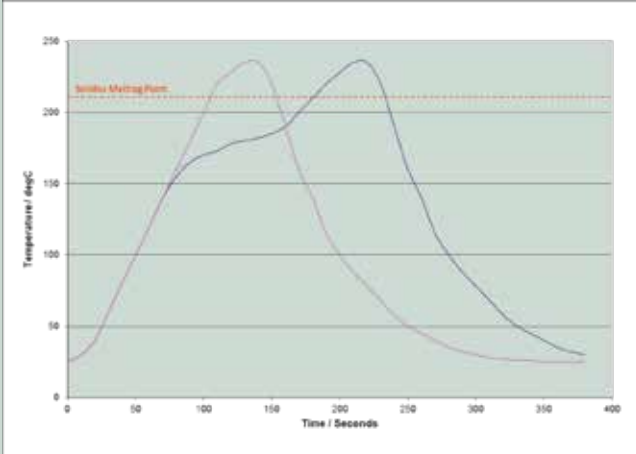
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Reflow

Reflow Profile

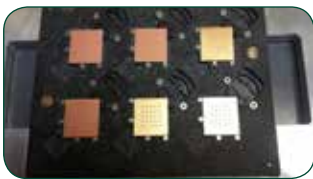
Reflow Profiles: SAC305



WS-575-C-RT is suitable for air and nitrogen reflow, and can work well in a variety of reflow profiles.

Movement During Reflow (MDR) and Solderability Test Method

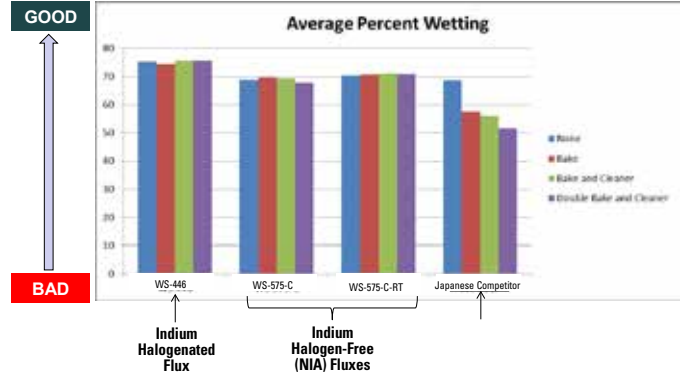
- Print flux onto metallized surface
- Place spheres onto flux deposit
- Reflow (air or N₂ [typical])
- Measure reflowed height deposit
- Calculate percent spread (wetting)
- Calculate mean sphere center movement (MDR)



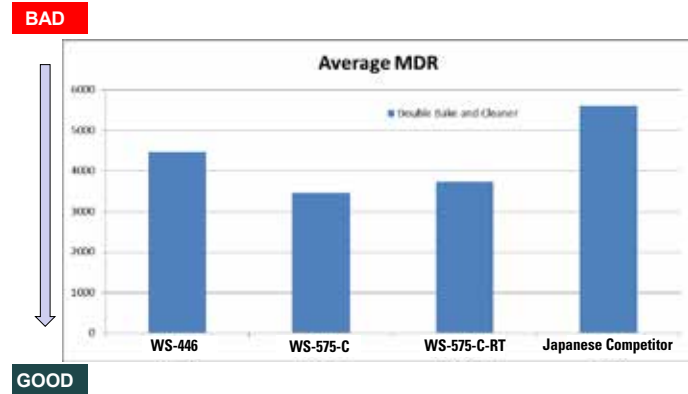
Copper OSP Substrates



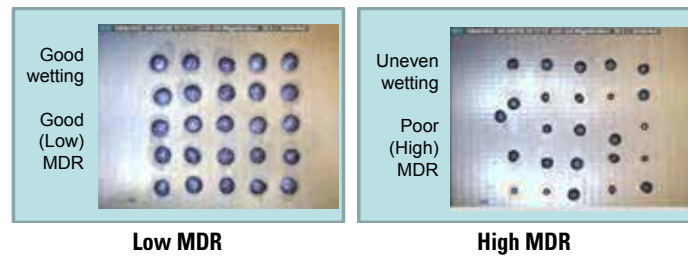
Wetting Comparison



MDR for Different Fluxes



MDR Correlates with Missing Ball



Eliminate Missing Ball and Increase Joint Strength

WS-575-C-RT's eliminates missing ball during reflow by high viscosity and rapid soldering. Joint strength is high due to good wetting.

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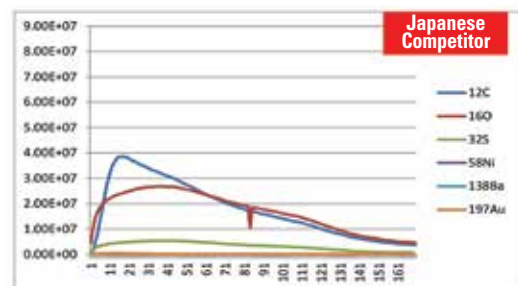
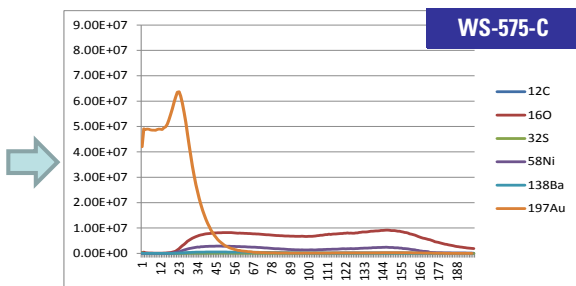
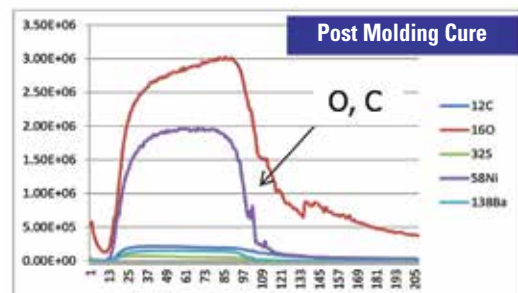
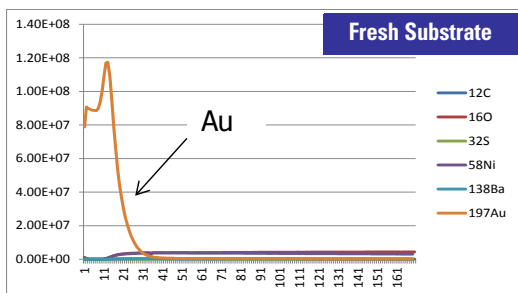
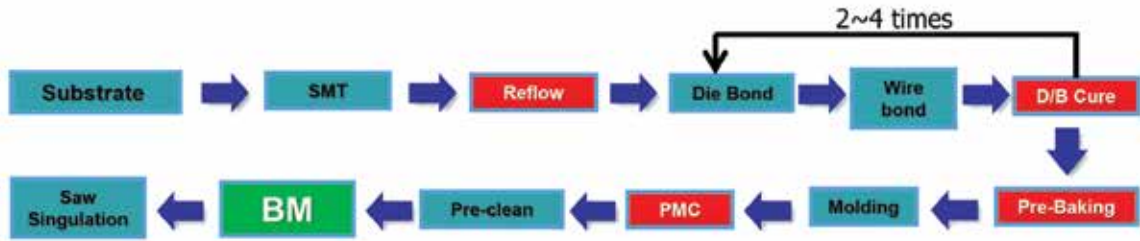


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Cleaning

Secondary Ion Mass Spectrometry (SIMS) Shows Species at the Surface



Cleaning Test

- **Very mild (forcing) condition**
 - Deionized water temperature: 36°C
 - Deionized water conductivity $\leq 1.00\mu\text{S}/\text{cm}$
 - Zero pressure
 - Flow rate 5cc/minute
 - Time of cleaning: 1 minute



Simplified, Low-Cost Cleaning

WS-575-C-RT is cleanable with room temperature deionized (DI) water only, eliminating chemical cleaning costs and costs of heating water.

| | WS-446 | WS-575-C | WS-575-C-RT | Japanese Competitor |
|------------------------------|--------|----------|-------------|---------------------|
| Baked and Cleaner OSP | | | | |
| Double Baked and Cleaner OSP | | | | |



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Final Test

Customer and Process Validation

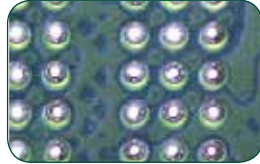


Flux



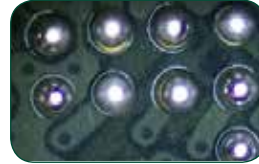
Flux on Flux Tray

Flux is normal on flux tray



Ball Mount

After ball mount, flux and ball position are good



Post Reflow

No missing ball and flux residue is clear



Post DI W Clean

No missing ball and no flux residue

Recommended Semiconductor Fluxes and Solder Pastes

| Material Group | Material Type | Material Name | Flux Type | Halogen-Free | Application | Comments | |
|----------------|--------------------|---------------|-------------|------------------------------|--------------|---|--|
| FLUX | Wafer Bumping Flux | WS-3543 | Water wash | No Intentionally Added (NIA) | Spin coating | High viscosity for taller copper pillars and larger bumps (>40 microns) | |
| | | WS-3401 | Water wash | NIA | Spin coating | Low viscosity for smaller pillars and bumps | |
| | Flip-Chip Flux | WS-446 | Water wash | No | No | Dipping | Best flux for poor solderability |
| | | WS-688 | Water wash | NIA | NIA | Dipping (can be strayed at 60°C) | Minimizes voiding |
| | | WS-580 | Water wash | NIA | NIA | Dipping | Best all-around HF flip-chip flux Easily cleaned |
| | | WS-3555 | Water wash | NIA | NIA | Spraying | Ultra-low residue no-clean |
| | | NC-26A | No-clean | NIA | NIA | Dipping | Best compatibility with CUF/MUF |
| | Ball-Attach Flux | NC-26S | No-clean | NIA | NIA | Dipping | Avoids capillary flow up to die surface for fine-pitch devices |
| | | WS-3600 | Water wash | No | No | Pin transfer | Best flux for poor solderability |
| | | | WS-575-C-RT | Water wash | NIA | Pin transfer | Best ball-attach flux for missing ball Eliminates the prefluxing step for OSP |

| Material Group | Material Type | Material Name | Flux Type | Halogen-Free | Alloy | Comments |
|---------------------|-------------------------|---------------|-------------------------|-------------------|--------------------------------------|---|
| SOLDER PASTE | Die-Attach Solder Paste | SMQ®75 | No-clean ("Power-Safe") | NIA | All high-Pb and Sb-containing alloys | Ultra-low residue "Power-Safe" (no-clean) paste suitable for clip-bonded devices |
| | | SMQ®51-SC | Solvent clean | No | | Best all-around cleanable die-attach paste |
| | | BiAgX® | Solvent clean | NIA | BiAgX® - mixed alloy system | High-temperature Pb-free solder paste |
| | SiP Solder Paste | Indium3.2HFA | Water wash | Halogen Compliant | SAC305 and other Pb-free | Type 6-SG solder paste suitable for ultrafine pitch printing Designed for 01005 and smaller discrete devices |

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