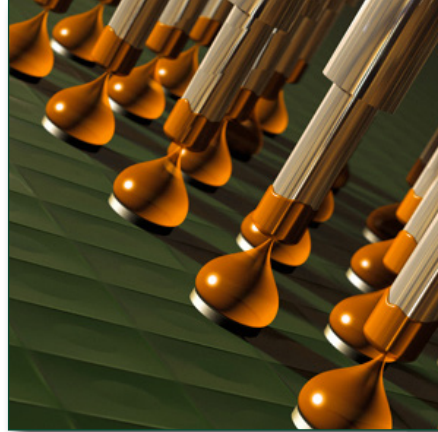


## PRODUCT DATA SHEET

# Halogen-Free Ball-Attach Flux WS-575-C-RT

## Introduction

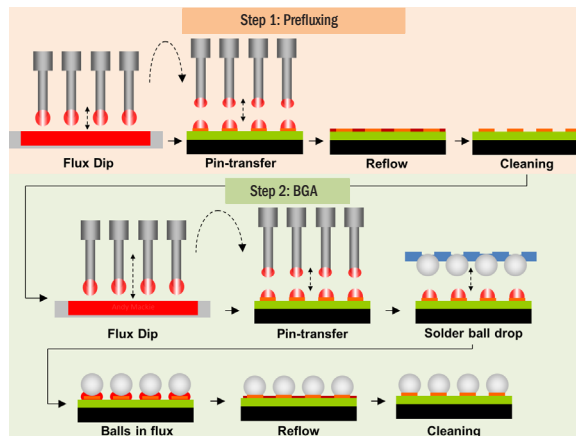
Indium Corporation's **Ball-Attach Flux WS-575-C-RT** allows customers to use a completely halogen-free (NIA = no intentionally added halogens) single-step ball-attach process to eliminate the costly, wasteful, and warpage-inducing effects of prefluxing. The "Standard Ball-Attach Process" diagram shows the typical two-step flux processing that is needed to create reliable, ball-to-pad joints from 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:	ORHO	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 <sup>8</sup> 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.

Form No. 99207 (A4) R3

[www.indium.com](http://www.indium.com)

[askus@indium.com](mailto:askus@indium.com)

ASIA: Singapore, Cheongju, Malaysia: +65 6268 8678  
 CHINA: Suzhou, Shenzhen: +86 (0)512 628 34900  
 EUROPE: Milton Keynes, Torino: +44 (0) 1908 580400  
 USA: Utica, Clinton, Rome, Chicago, Rome: +1 315 853 4900

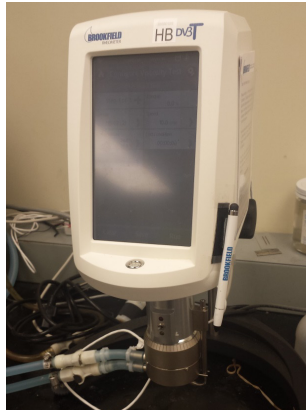


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## Viscosity Test Method

- **Equipment**
  - Brookfield Cone and Plate
  - Model: DV3THBCB
- **Parameters**
  - Spindle: CP-51
  - Temperature: 25 °C
  - RPMs: 20 RPM



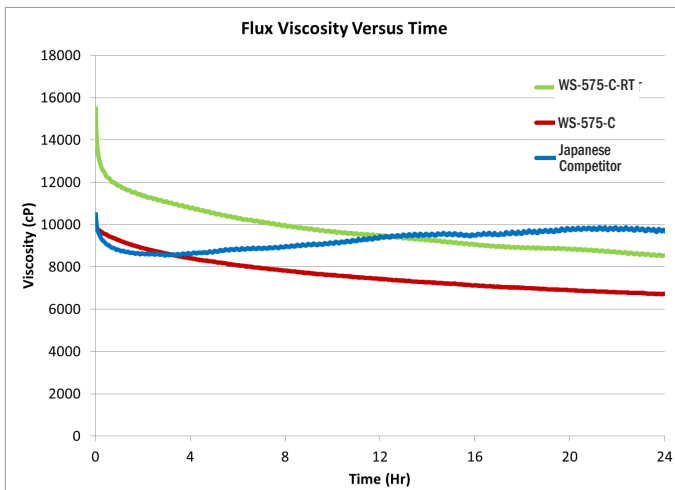
## Tack Test Method

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

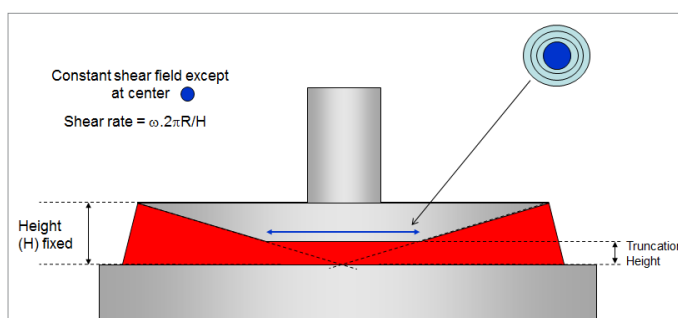
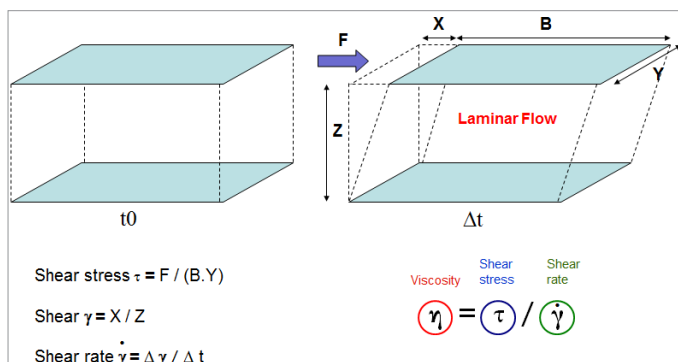
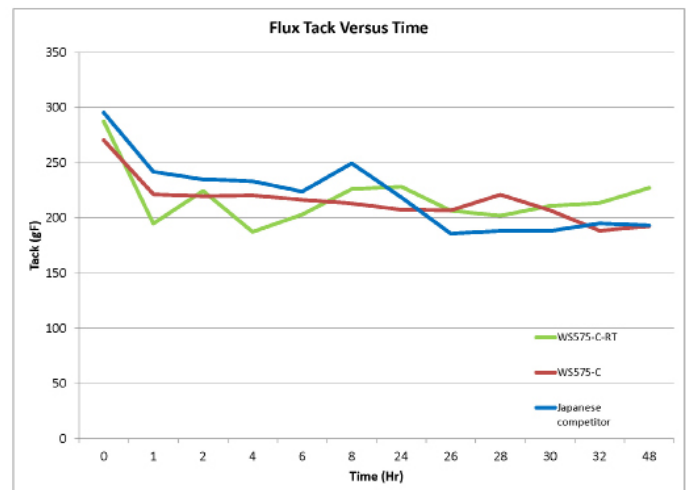


## Comparative Viscosities as a Function of Time

### Viscosity Controls



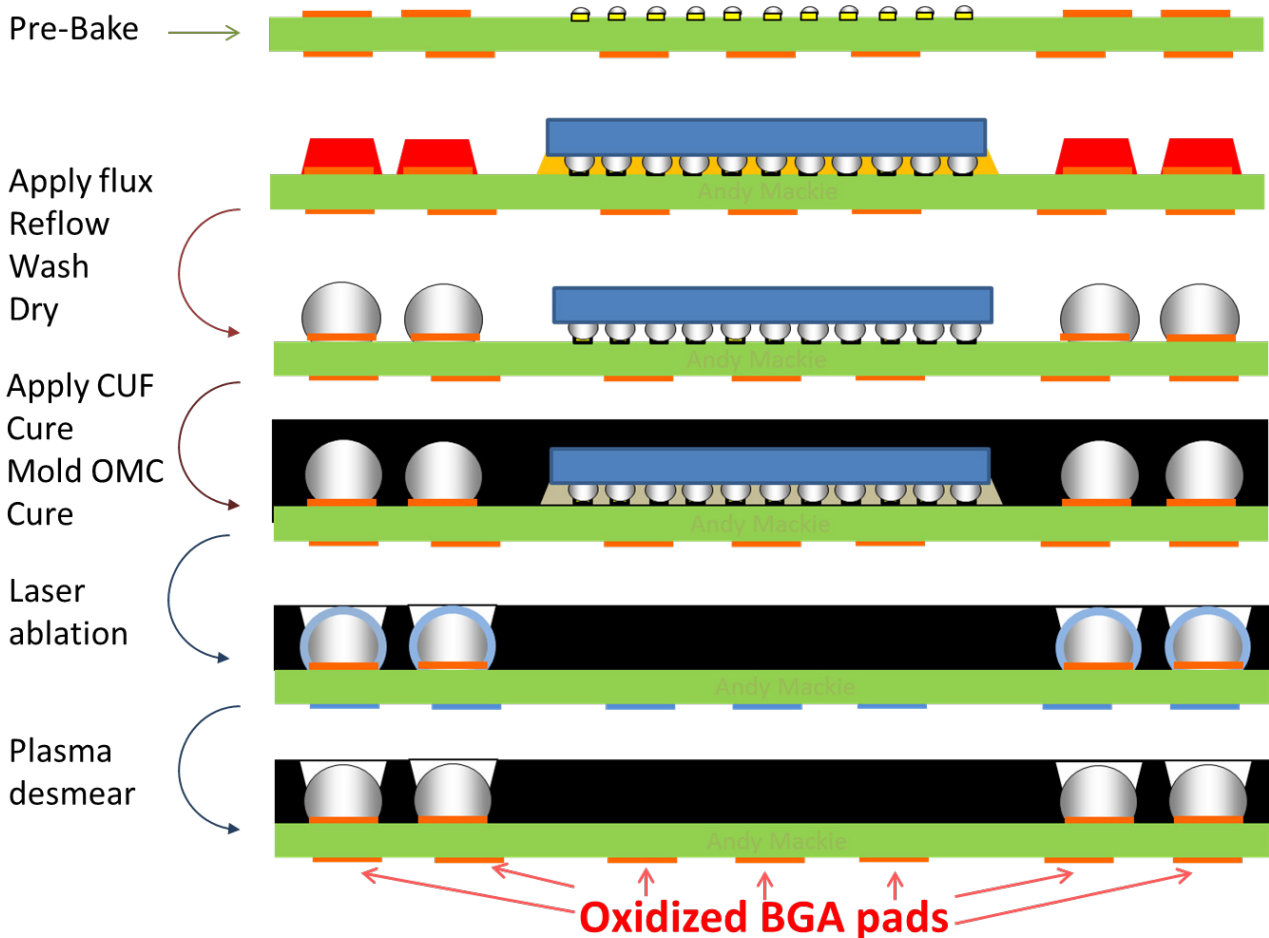
## Tack as a Function of Time



## Consistent Flux Deposition

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

## OSP Degradation From FCBGA Substrate Treatment Before BGA Balling



### 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

### Test Materials and Reflow

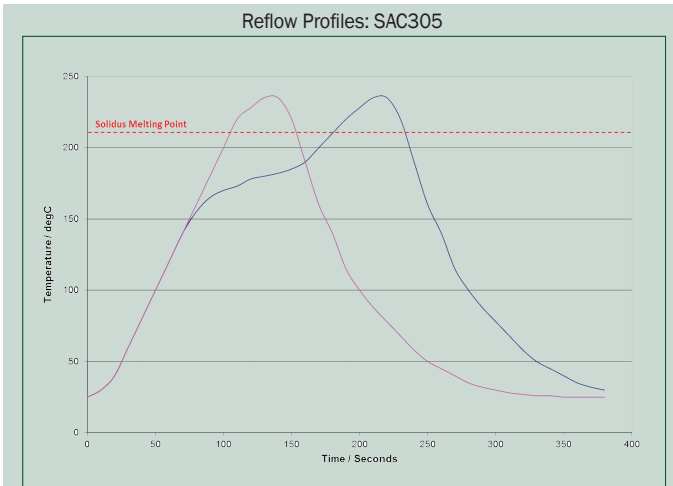
- **Solder Spheres**
  - SAC305, 28mil
  - 7-hour bake @ 130°C
- **Reflow**
  - Soak (preheat) reflow profile
  - Air reflow
- **Substrates**
  - OSP substrates

### Eliminate Extra Costs and Warpage

*For flip-chip BGA, bottom pads can become extremely oxidized. **WS-575-C-RT** eliminates the need for a prefluxing step, which reduces:*

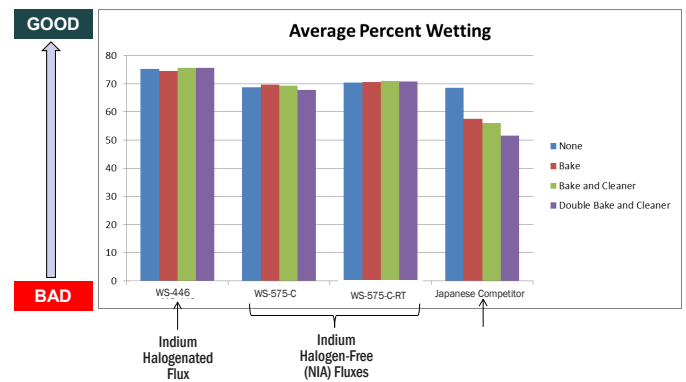
- Process cost
- Package warpage
- UPH

## Reflow Profile

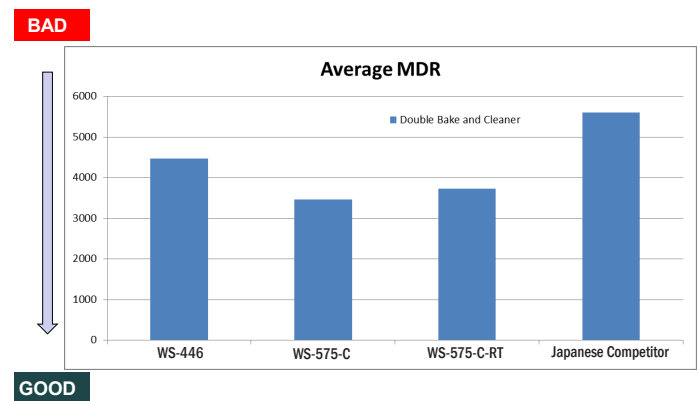


WS-575-C-RT is suitable for air and nitrogen reflow, and can work well in a variety of reflow profiles.

## Wetting Comparison

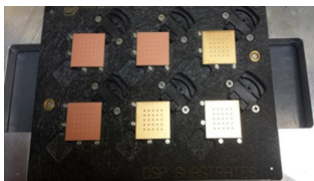


## MDR for Different Fluxes



## Movement During Reflow (MDR) and Solderability Test Method

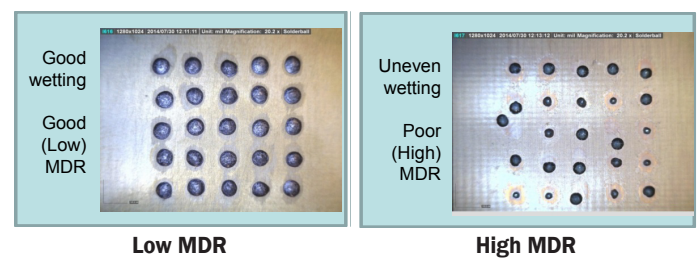
- Print flux onto metallized surface
- Place spheres onto flux deposit
- Reflow (air or N<sub>2</sub> [typical])
- Measure reflowed height deposit
- Calculate percent spread (wetting)
- Calculate mean sphere center movement (MDR)



Copper OSP Substrates



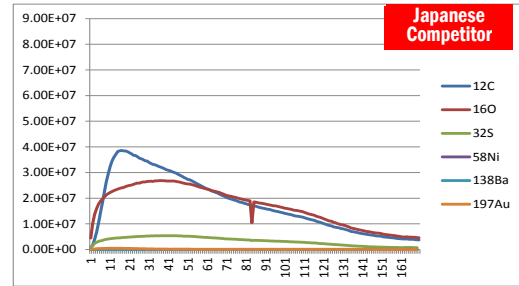
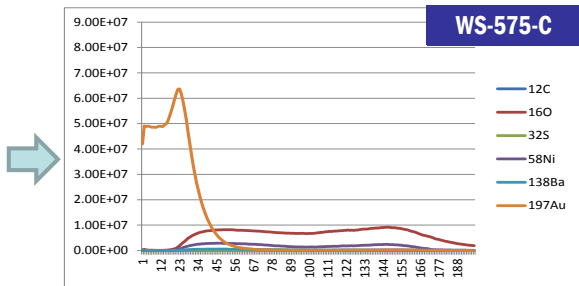
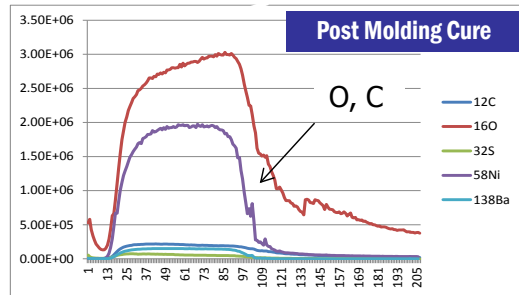
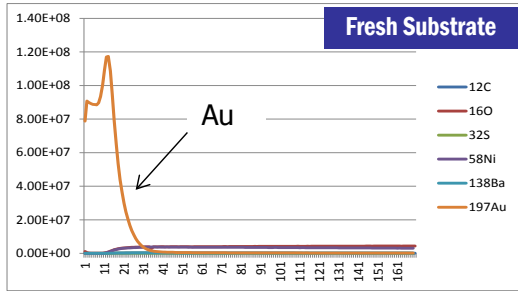
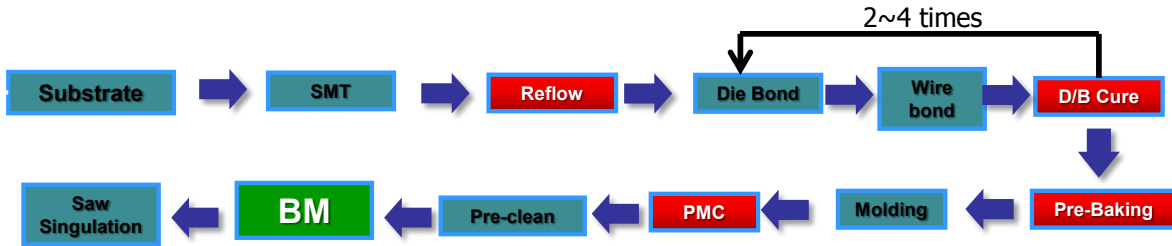
## MDR Correlates with Missing Ball



## Eliminate Missing Ball and Increase Joint Strength

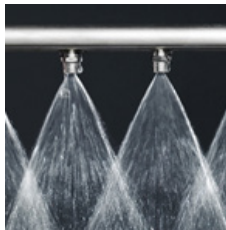
WS-575-C-RT eliminates missing ball during reflow by high viscosity and rapid soldering. Joint strength is high due to good wetting.

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



### Cleaning Test

- **Very mild (forcing) condition**
  - Deionized water temperature: 36 °C
  - Deionized water conductivity <=1.00µS/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				

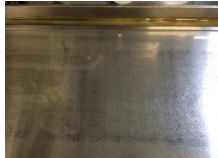


## Ball-Attach Flux WS-575-C-RT: Final Test

### Customer and Process Validation

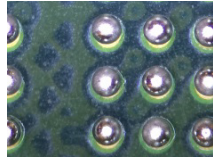


**Flux**



**Flux on Flux Tray**

Flux is normal on flux tray



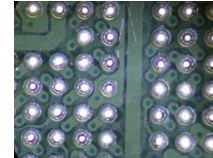
**Ball Mount**

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
<b>FLUX</b>	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	Dipping	Best flux for poor solderability
		WS-688	Water wash	NIA	Dipping (can be strayed at 60C)	Minimizes voiding
		WS-580	Water wash	NIA	Dipping	Best all-around HF flip-chip flux Easily cleaned
		WS-3555	Water wash	NIA	Spraying	Ultra-low residue no-clean
		NC-26A	No-clean	NIA	Dipping	Best compatibility with CUF/MUF
	Ball-Attach Flux	NC-26S	No-clean	NIA	Dipping	Avoids capillary flow up to die surface for fine-pitch devices
		WS-3600	Water wash	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
<b>SOLDER PASTE</b>	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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[www.indium.com](http://www.indium.com)

[askus@indium.com](mailto:askus@indium.com)

ASIA: Singapore, Cheongju, Malaysia: +65 6268 8678

CHINA: Suzhou, Shenzhen: +86 (0)512 628 34900

EUROPE: Milton Keynes, Torino: +44 (0) 1908 580400

USA: Utica, Clinton, Chicago, Rome: +1 315 853 4900



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