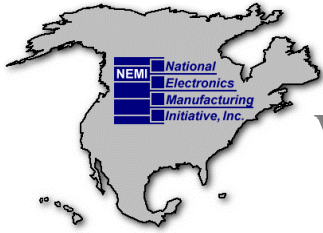


Wave Soldering with Lead Free Alloys

Denis Barbini
Vitronics-Soltec
01-17-01



Wave Soldering with Lead Free Alloys

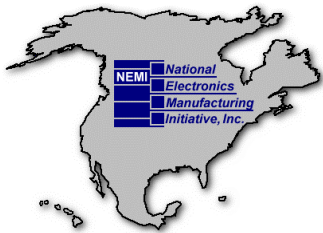
Process related issues:

- **Acceptable processing temperature (preheat and solderpot temperature)**
- **Materials Compatibility**
 - flux, board type/finish
- **Contact time**
- **Dross**
- **Narrow Plastic Range**
- **Acceptable Wetting (fillet lifting, fillet cracking, THP)**
- **Form reliable joints (intermetallics, low melting point alloys)**

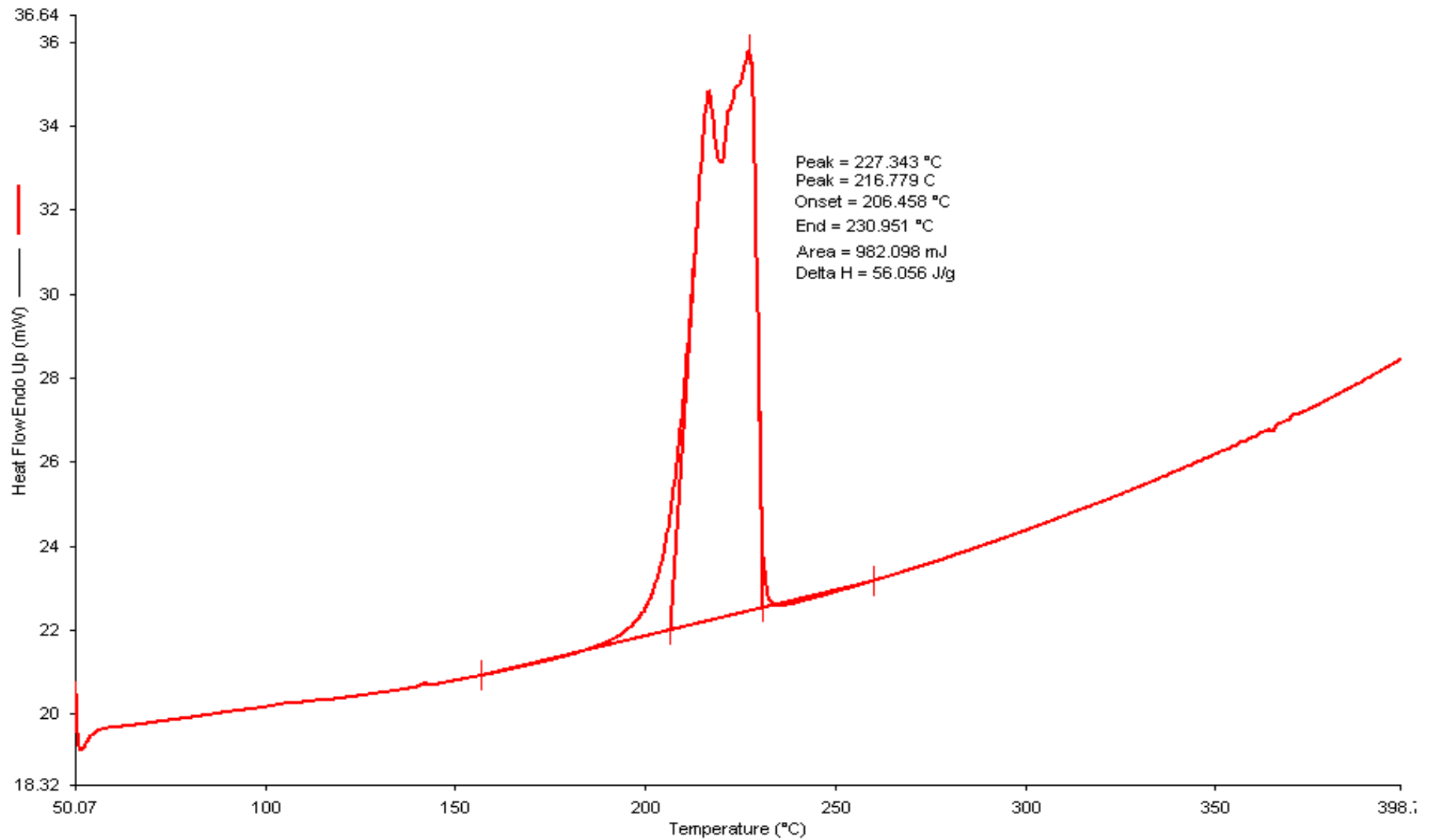
Equipment related issues:

- **High yield and low cycle time**
- **Solder temperature**
- **Solderpot integrity**
- **Waveformers**
- **Atmosphere**
- **Dross buildup**

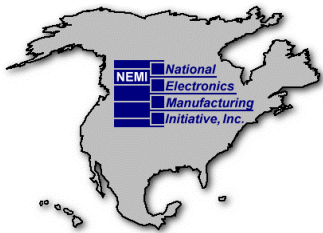
Connect with and Strengthen Your Supply Chain



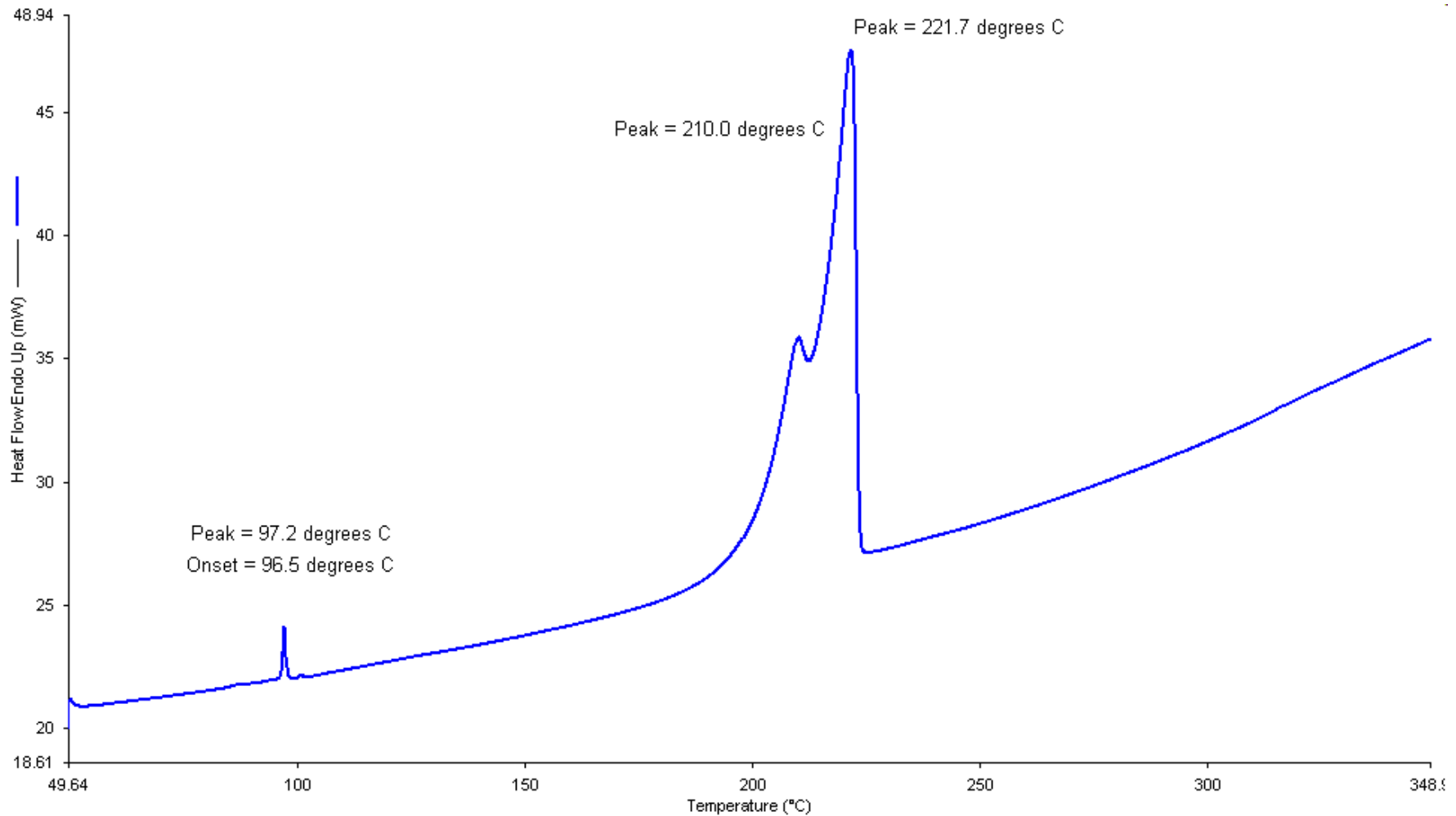
Lead Free Wave - SBA+



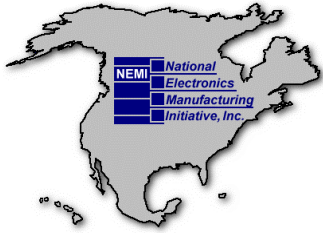
Connect with and Strengthen Your Supply Chain



Lead Free Wave - Customer SBA+



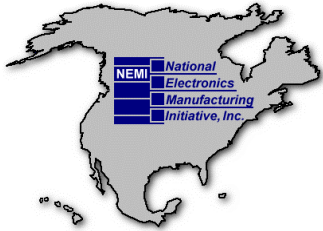
Connect with and Strengthen Your Supply Chain



Wave Soldering - Characterizing the Issues

- **Lead free wave soldering**
 - Taguchi experiment focused on identifying critical parameters including atmosphere, pot temperature, preheat temperature, contact time, flux type and amount, board finish, and component finish for 5 alloys.

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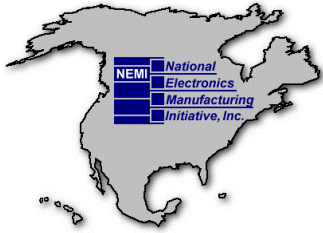
Taguchi Design of Experiment

L9 Orthogonal Array				
Label	Factor name	Level 1	Level 2	Level 3
A	Solder temperature	250	260	275
B	Contact time	2	3	5
C	Preheat temperature	90	110	130
D	Flux amount	20	30	50

Example of a L9: 4 factors at 3 levels.

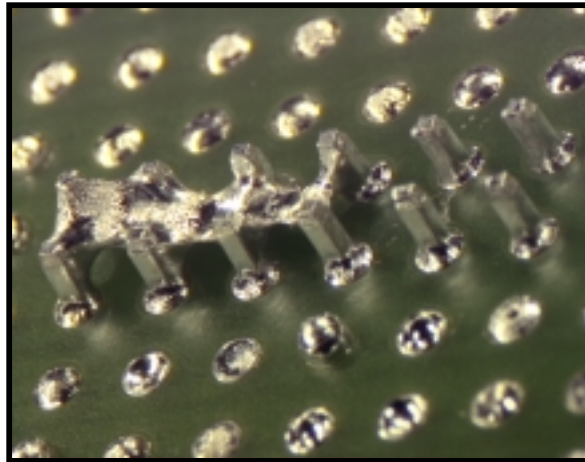
L9 Orthogonal array	Levels			
	Run:	Solder temp.	Contact time	Preheat temp
1	1	1	1	1
2	1	2	2	2
3	1	3	3	3
4	2	1	2	3
5	2	2	3	1
6	2	3	1	2
7	3	1	3	2
8	3	2	1	3
9	3	3	2	1

Connect with and Strengthen Your Supply Chain



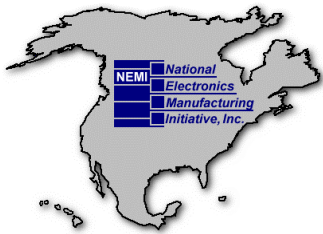
Failure Modes

The data should be examined against the criteria of the output characteristics.

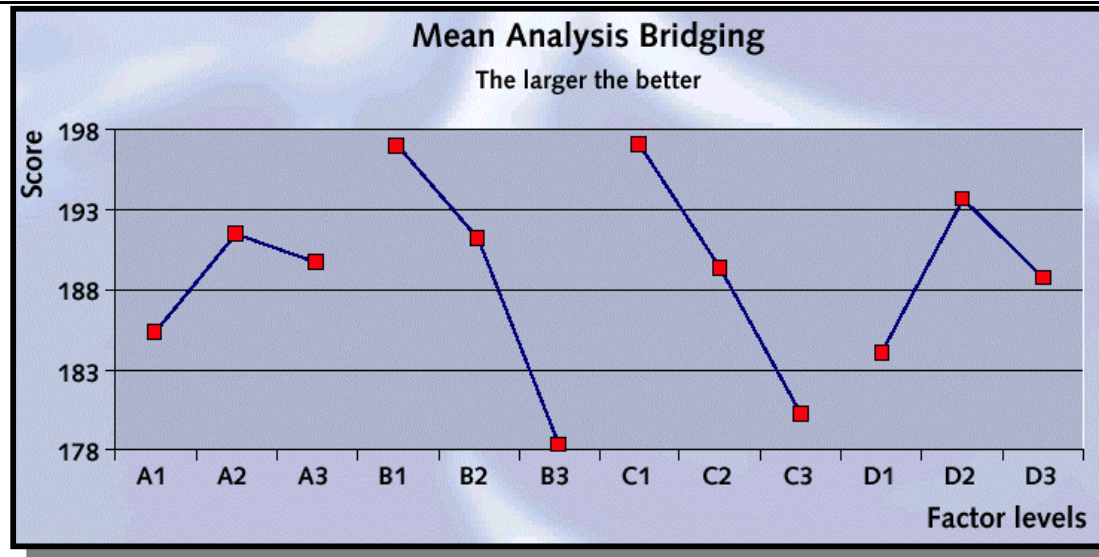


One of the output characteristics can be the number of bridges.

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Process Optimization as a Function of Bridging



Score for bridging:
The larger the number
the better

The software returns the best settings:

A2 = solder temperature at 260 degr.C

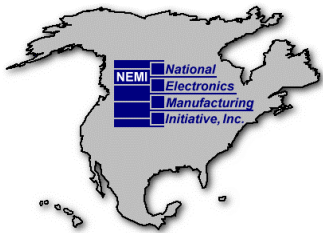
B1 = contact time 2 seconds

C1 = preheat temperature at 90 degr. C

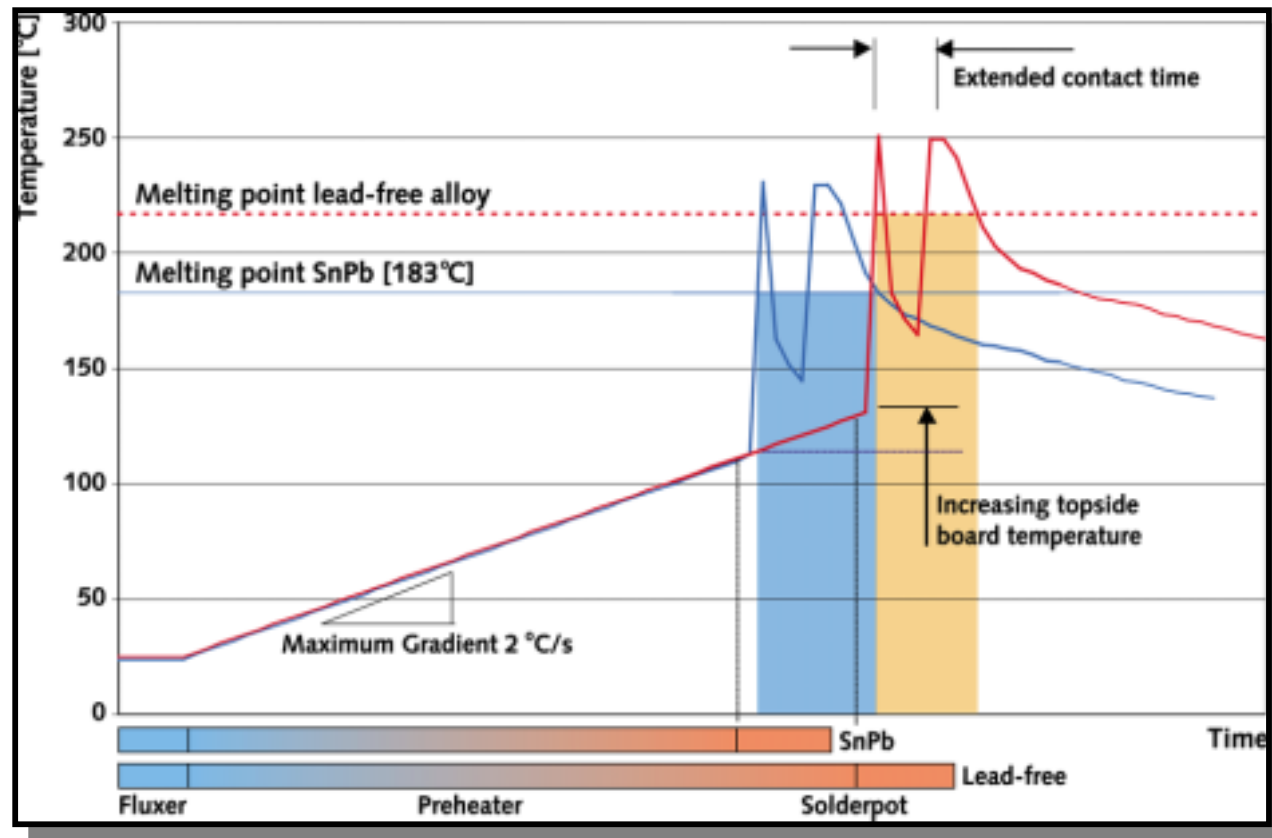
D2 = flux amount at 30 Hz

These settings are typical for this board, with this flux and this lead-free alloy.

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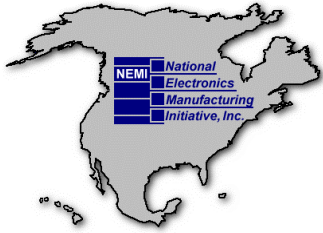


Process Implications



Difference between SnPb and lead-free wave soldering

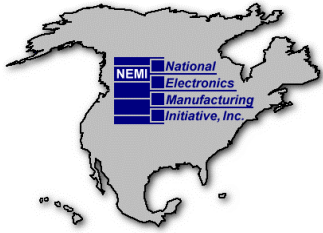
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Process conditions - wave soldering -

<i>Process conditions: Double sided / Plated holes</i>			
Solder temp.	250°C	260°C	265°C
Soldering time	≥3.5s	≥3.0s	≥2.5s
Preheating temp.	≥100°C (depends on flux only)		
<i>Process conditions: Single sided / Plain holes</i>			
Solder temp.	245°C	250°C	260°C
Soldering time	-	≥3.0s	≥2.5s
Preheating temp.	≥100°C (depends on flux only)		

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Conclusions

- **Changes in one parameter have significant implications on the entire process.**
- **In general, nitrogen over the wave allows for better wetting.**
- **Contact times will be a function of conveyor speed, and temperature.**
- **Today's fluxes are still maturing for lead free processing.**

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