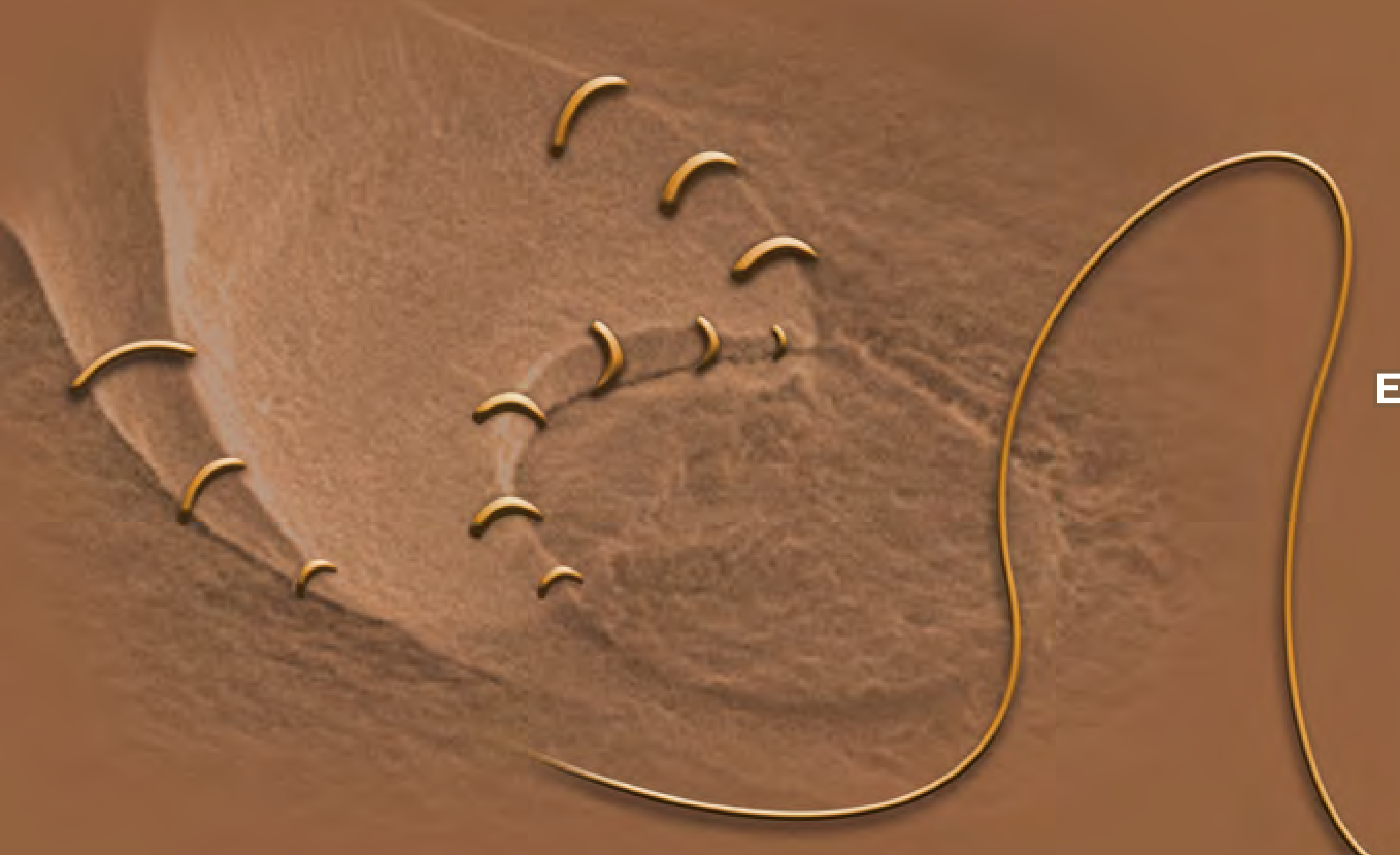
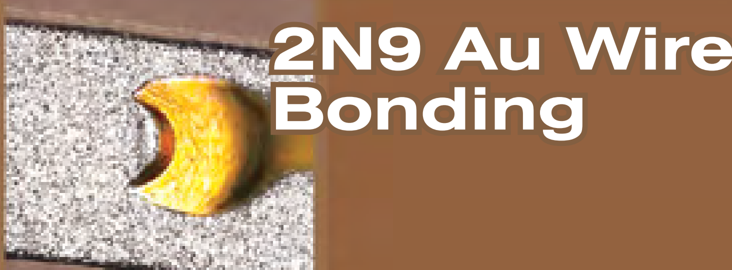


STITCH INTEGRATOR

ENHANCED STITCH BONDABILITY



2N9 Au Wire Bonding

Challenging Substrates

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2N9 Au Wire Bonding

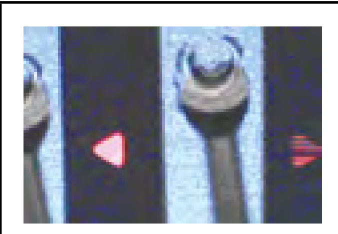
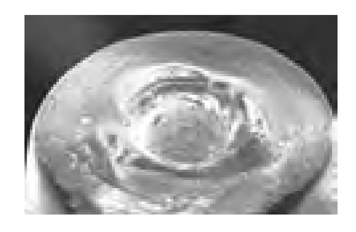
The use of 2N9 Alloyed Au wire is becoming popular for fine-pitch and ultra-fine pitch bonding. These wires consist of 99% Au purity with 1% Pd and are formulated with dopant to enhance the looping capability and ball bond reliability. However, these wires are generally harder and more prone to wire breakage and non-sticking problem during stitch bond formation resulting in higher yield loss during production, especially for leaded devices. The nature of the lead frame design with certain degree of bouncing effect during bonding further complicates the robustness of the bonding process.

The challenge is to be able to improve the stitch bondability for 2N Alloyed Au wire. The ***Stitch Integrator*** capillary helps to improve the bonding performance as shown in the following application.

Bonding Condition:

Capillary	*SI* - 31090-385F-ZB34TP
Bond Pad Pitch	70um
Bonder	ASM 339 Eagle
Wire Type	1mil 2N Au wire
Device	Lead frame base, QFP 176L

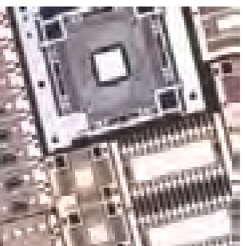
Bonding responses monitoring for SI capillary:

			Wire Pull (gf): Average : 7.1 Std Dev : 1.11 Stitch Pull Average : 7.4 Std Dev : 0.82
Stitch bond before and after destructive test (@ 600K bonds)		Capillary condition @ 600K bonds	

Key Notes:

- The enhanced coupling effect between the SI capillary and the alloyed wire has proven to improve the bondability of the stitch bond with minimum interruption to the bonder.
- At 600K bonds, the load-up condition on the capillary is satisfactory with no excessive load-up accumulation at the tip of the capillary.
  (Note: standard tool life is set at 500K bonds)
- Destructive test performed through wire pull @ 1/3 wire length did not reveal any abnormality with the stitch bonds as all the wires break @ neck location. This indicates that the stitch bond adhesion is satisfactory with no bond reliability issue. Sample size = 1500 wires.
- Bonder stoppages due to wire open and short tail defect rate were recorded at less than 1000ppm while regular bonder stoppages was encountered with non-SI capillary.

Challenging Substrates



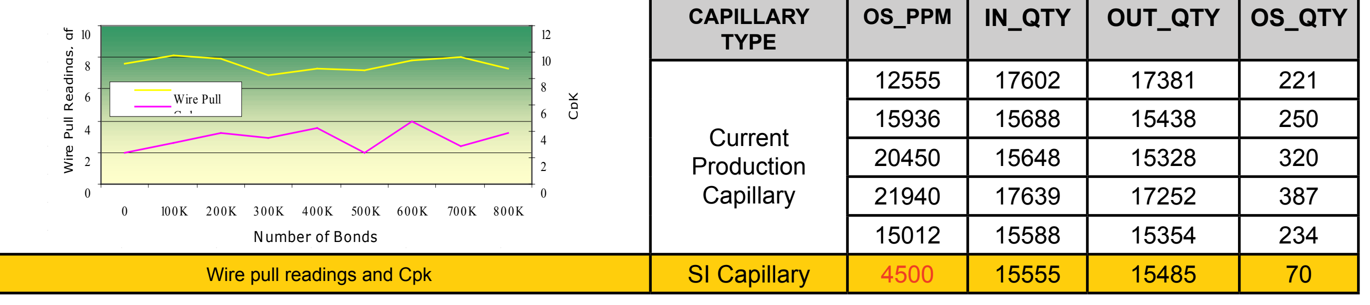
The pressure to reduce the cost of products has indirectly instilled certain elements of inconsistency to the lead frame and substrate materials, which directly affect the bond reliability of the stitch bonds. Inconsistent lead frame and substrate quality often results in NSOL, short tail or low stitch pull readings during wire bond. Most of the time, the problem is only known after die attach and during wire bond.

The challenge is to be able to improve the stitch bondability for these types of lead frames/substrates. The ***Stitch Integrator*** capillary helps to improve the bonding performance as shown in the following application.

Bonding Condition:

Capillary	*SI* - 31080-375F-ZB34TP
Bond Pad Pitch	60um
Bonder	KNS 8028
Wire Type	1mil Au wire
Device	Lead frame base

Bonding responses monitoring for SI capillary:



	CAPILLARY TYPE	OS_PPM	IN_QTY	OUT_QTY	OS_QTY
	Current Production Capillary	12555	17602	17381	221
		15936	15688	15438	250
		20450	15648	15328	320
		21940	17639	17252	387
		15012	15588	15354	234
Wire pull readings and Cpk	SI Capillary	4500	15555	15485	70

Key Notes:

- Destructive test for both ball shear and wire pull has shown that the bondability for the ball and stitch bonds was within the manufacturing specification with good Cpk control.
- Visually, the ball and stitch bonds at 800K bonds did not show any symptoms of golf ball, irregular ball squashed out or damaged stitch bonds.
- Bonder stoppages throughout the tool life of the SI capillary was recorded at, NSOL: 614ppm, short tail: 512ppm. No EFO open was encountered.
- During the O/S test, device failure bonded using the SI capillary showed a substantial reduction in ppm as compared to non-SI capillary on the same device type. Overall, the SI capillary showed an improvement of more than 70% with reduced second bond failure. This indicates that the stitch bondability has improved using the SI capillary.