

# X-Wire™ – Insulated Wire Bonding Technology

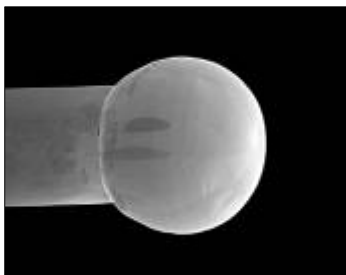
X-Wire™

Advanced wire bonding technology is constantly being driven to higher geometric capability (finer pitches, longer loops) resulting in increasing packaging and assembly costs. X-Wire™ Technology helps address these critical issues by providing a continuous insulating coating on today's bonding wires. X-Wire™ Technology uses existing wire bond assembly infrastructure and processes.

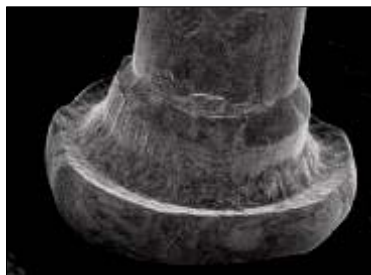
Table 1, presents a typical X-Wire™ bonding performance obtained on several package types representative of the present mix in semiconductor assembly operations. The evaluation was performed using an ASM® Eagle® 60 wire bonder, using capillaries from SPT.

**Table 1: ASM® Evaluation of X-Wire™**

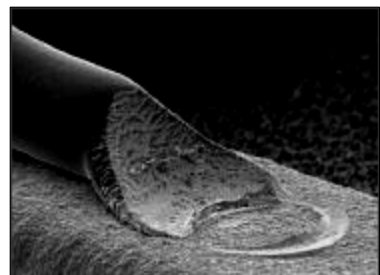
	X-Wire™ Ø 20 µm	X-Wire™ Ø 25 µm
<b>1<sup>st</sup> Bond Geometry</b>		
<b>Bond Pad Pitch</b>	50	65
<b>Ball Diameter (µm)</b>	39	53
<b>Ball Height (µm)</b>	10	12
<b>1<sup>st</sup> Bond Strengths</b>		
<b>Shear Force (g)</b>	12.0	23.2
<b>Shear Strength (g/mil<sup>2</sup>)</b>	6.5	6.9
<b>2<sup>nd</sup> Bond Strengths</b>		
<b>Stitch Pull (g)</b>	4.4	8.5
<b>Capillary</b>	SPT SBN-25063-305F-ZP38T	SPT SBNE-33AR-AZM-1/16-XL



Free Air Ball



1<sup>st</sup> Ball Bond



2<sup>nd</sup> Stitch Bond

The performance of X-Wire™ Technology in trial production operations demonstrates the robustness required for present and future manufacturing requirements. First and second bond X-Wire™ bond morphologies are shown in above, and are very typical of acceptable industry standards.



Microbonds



The Process of Innovation™

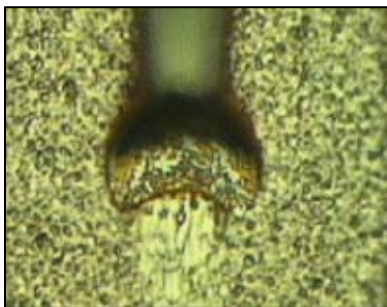
Adhesion of the coating has been found to be exceptional before, during and after bonding operations. No de-lamination of the coating from the base wire is noted in the micrographs, notwithstanding the typical plastic deformation necessary to produce the second bond (stitch). During ball formation, the wire remains coated down to the neck and on top of the free air ball. During 2<sup>nd</sup> bond the coating exfoliates, by design, underneath the second bond, enabling a strong stitch bond, confirmed by pull strength. Special techniques developed by ASM® on the Eagle® 60 platform, can provide even higher pull strengths, when required.

## 20 µm X-Wire™ – ASM Customer Evaluation

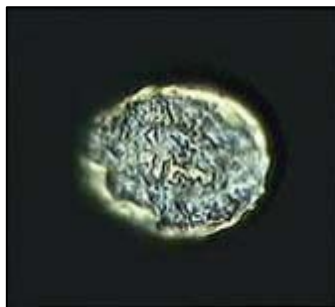
An ASM® customer identified a need for ultra-fine pitch insulated wire bonding to improve yield losses due to wire sweep. Through innovative ASM® bond process techniques, the previously recommended minimum bond pad pitch of 55 µm was reduced to 47 µm, with a 44 µm bond pad opening. Using an SPT capillary, the bondability of 20 µm X-Wire™ met the customer qualification requirements in regards to strengths, geometry, IMC, and consistency. Results are shared in the Table 2 and images below.

**Table 2: ASM® Evaluation 20 µm Ø X-Wire™, SPT Capillary**

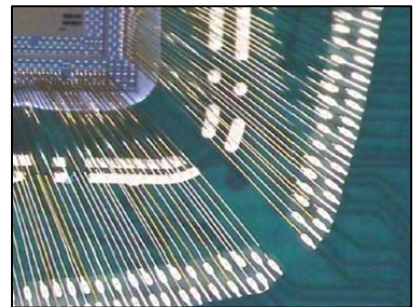
1 <sup>st</sup> Bond Geometry		Standard Deviation
Ball Diameter (µm)	35.5	0.4
Ball Height (µm)	9.9	0.7
1 <sup>st</sup> Bond Strengths		
Shear Force (g)	10.7	0.4
Shear Strength (g/mil <sup>2</sup> )	6.9	-
2 <sup>nd</sup> Bond Strengths		
Stitch Pull (g)	4.4	0.3
Neck Pull (g)	7.0	0.3



Stitch Bond



IMC



Fine Pitch

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