

## Silver Alloy Wire Bonding



A huge increase in the price of gold (Au) has driven the need for lower cost wire materials. Copper, Palladium Coated Copper (PCC) and Silver (Ag) alloy wires

have emerged as alternatives to gold bond wires. Copper-based wires are low cost and have excellent electrical resistivity. However, the hardness of copper makes it difficult to use in many applications such as those with fragile bond pad structures. For these applications, Ag-Alloy offers properties similar to those of gold while its cost is similar to that of PCC.

### Key Features

- Ag-Alloy wire is softer than PCC resulting in lower Al-Splash and lower risk of bond pad damage
- Ag-Alloy wire has a wide process window that improves manufacturability for devices with fragile bond pad structures

### Benefits

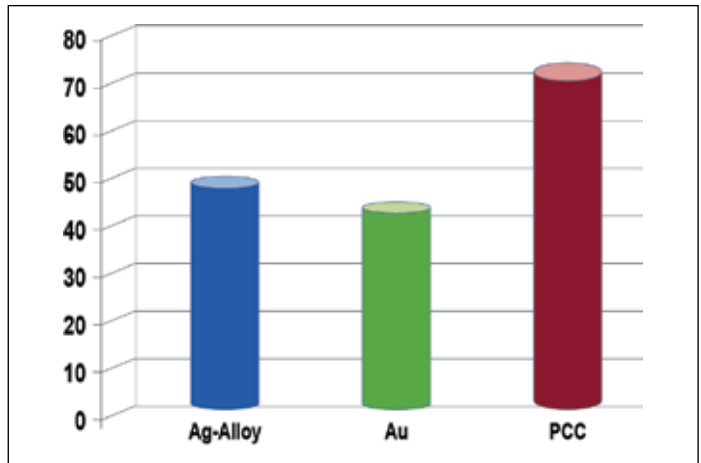
Ag-Alloy wire is the best low cost replacement for applications that need:

- Die-to-die bonding, waterfall bonding
- Ultra-fine bond pad pitch (BPP) and small bond pad openings (BPO)
- Ultra low loop height

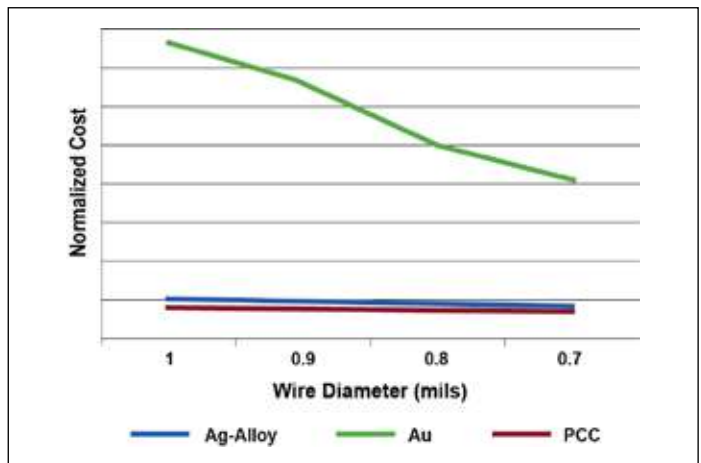
Package Families Using Ag-Alloy Wire	
CABGA	PSOP
LQFP	SC70
MLF	SCSP
MQFP	SOIC
PBGA	SOT-23
PDIP	SSOP
PLCC	TQFP
	TSSOP

Note: Contact Amkor for detailed production and development status of specific package families.

Free Air Ball (FAB) Hardness (Hv)



Wire Cost Comparison



### Ag-Alloy Wire Readiness

	In Production	In Development
Process Nodes	20 nm	< 20 nm
Wire Diameter	18 μm	15 μm
Inline Bond Pad Pitch	40 μm	35 μm
Staggered Bond Pad Pitch	25/50 μm	20/40 μm
Standoff Stitch Bonding Pad Pitch	50 μm	40 μm

Visit Amkor Technology online for locations and to view the most current product information.



TS108A  
Rev Date: 9/14

## Comparison of Different Wire Materials

	Ag-Alloy	Au	PCC	Impact
Wire Cost	Lower Cost	Expensive	Lowest Cost	PCC and Ag-Alloy wires are significantly cheaper than Au wire
FAB Hardness	Soft	Soft	Hard	Harder materials cause cratering, bond pad crack
Process Window (Force, Power, Time)	Wide	Wide	Narrow	Wider process window improves manufacturability for devices with fragile bond pad structures
Al Splash	Minimal	Minimal	More	Less aluminum splash is better for fine pitch and small BPO
Ultra-low Loop Capability	Excellent	Excellent	Limited	Ultra-low loop capability allows thinner packages
Resistivity	Good	Better	Best	Lower resistivity is better for high current carrying applications

## Properties of Different Wire Materials

		Ag-Alloy	Au	PCC
<b>Physical Properties</b>				
Hardness (Hv)	Free Air Ball (EFO = 120 mA)	50~60	44~49	70~80
	HAZ	50~60	44~49	55~65
	Wire	60~70	49~55	60~70
HAZ Length (um)		60~80	60~80	80~100
Density (g/cm <sup>2</sup> )		10.58	19.2	8.98
Elastic Modulus (Gpa)		60~70	80~90	90~100
Recrystallization Temp. (°C)		500~550	500~550	500~550
Melting Point (°C)		980~1010	1060~1080	1080~1100
Fusing Current (A, Length = 10 mm)		0.44	0.47	0.58
Resistivity (uΩ cm) @ 20°C		3.3	2.9	1.9
Thermal Conductivity (W/mk)		429	317	401
Coefficient of Thermal Expansion (0 ~ 100°C, ×10 <sup>-6</sup> /K)		19	14	17
Elongation (%)		2~12	2~7	3~17
<b>Material Composition</b>				
Purity (%)		> 95%	> 99%	99.98

Note: Numbers in the table above are based on wire diameter of 0.8 mil.

Visit Amkor Technology online for locations and to view the most current product information.



With respect to the information in this document, Amkor makes no guarantee or warranty of its accuracy or that the use of such information will not infringe upon the intellectual rights of third parties. Amkor shall not be responsible for any loss or damage of whatever nature resulting from the use of, or reliance upon it and no patent or other license is implied hereby. This document does not in any way extend or modify Amkor's warranty on any product beyond that set forth in its standard terms and conditions of sale. Amkor reserves the right to make changes in its product and specifications at any time and without notice. The Amkor name and logo are registered trademarks of Amkor Technology, Inc. All other trademarks mentioned are property of their respective companies. © 2014, Amkor Technology Incorporated. All Rights Reserved.

TS108A

Rev Date: 9/14