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CHARACTERISTICS AND ATTRIBUTES OF Olin Advanced Tin™ Barrier

Introduction

Tin (Sn) coatings have been used for years by terminal and connector manufacturers to maintain a stable separable contact interface over the life of the connector. The issue has been that most electrical and electronic connectors were made from copper (Cu) based alloys for their electrical conductivity, however, copper when coupled with tin will naturally diffuse. Figure 1 illustrates this phenomenon over time.

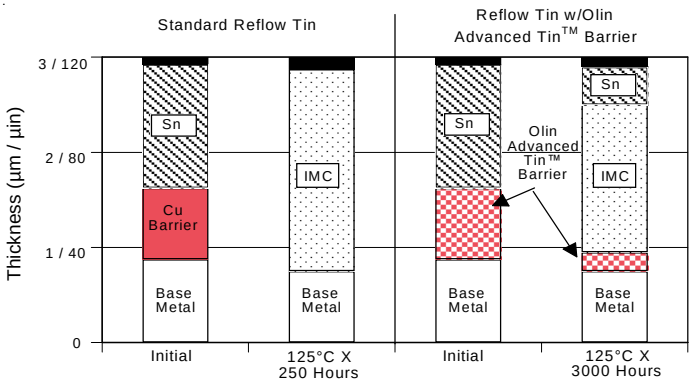

Figure 1. Intermetallic (IMC) formation of Reflow Tin on a copper substrate over time at 125°C with and without Olin Advanced Tin™ Barrier

The Sn plating is quite soft and allows for a mating contact to break through the thin surface oxide at reasonably low loads providing a good electrical path between two mating parts. (The oxide is depicted in Figure 1 as the solid dark area.) Should the layer under the oxide become harder through the formation of Cu-Sn IMC, much higher loads will be required to break through this surface oxide to achieve an acceptable electrical path. Figure 1 shows the presence of elemental Sn below the surface oxide after prolonged exposure to elevated temperature with a system protected by the Olin Advanced Tin™ Barrier.

How Olin Advanced Tin™ Barrier Works

Olin Advanced Tin™ Barrier was developed to slow this diffusion of copper into tin as much as nature will allow. Figure 2 illustrates that as the temperature increases, the rate at which intermetallic thickness grows is quicker without the use of Olin Advanced Tin™ Barrier. Even a typical Nickel (Ni) underlayer, such as a 50µin (1.2µm) Ni barrier, will force the specification of thick tins to ensure adequate amount of initially plated Sn required for good contact stability. Olin Advanced Tin™ Barrier shows exceptional ability to slow diffusion at temperatures up to 150°C.

What is Olin Advanced Tin™ Barrier

The barrier contains nickel and copper, which are commonly used in the electroplating industry. A thorough understanding of how these constituents behave and electroplating process control creates this performance.

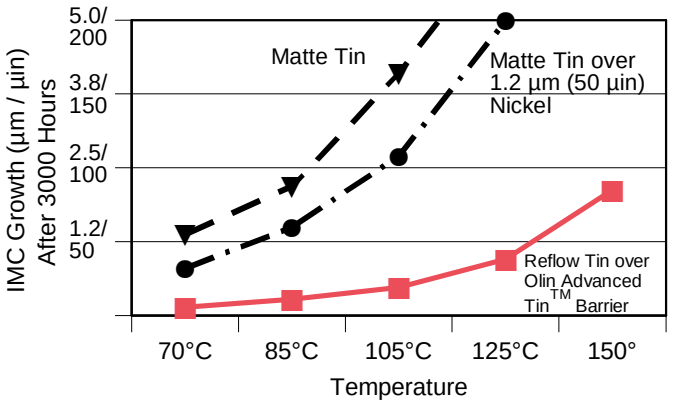

Figure 2. Copper-Tin Intermetallic formation for different plating systems at various temperatures after 3000 hours

Insertion Force Benefit & Electrical Performance

Inhibiting this IMC formation has allowed terminal design engineers to utilize thinner tin plating thicknesses while maintaining good electrical performance. Thinner tin platings provide for lower resistance to normal forces and similarly coefficient of friction. In this regard terminal manufacturers supporting US and Japanese OEM's have successfully pushed the use of reflow tin thicknesses down to below 40 uin (1um) realizing significant reductions in insertion efforts on multi-way terminal systems.

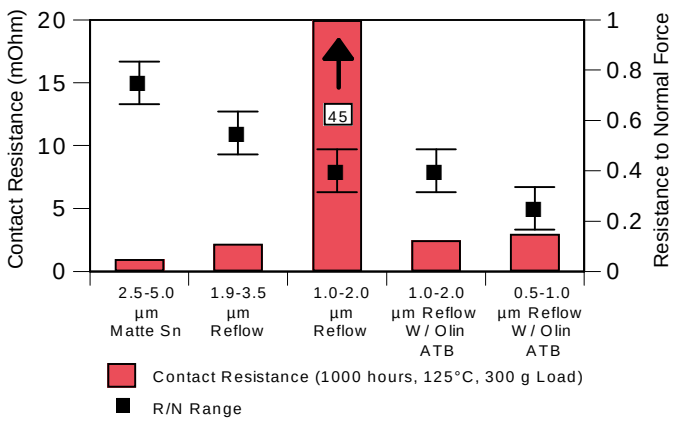

Figure 3. Contact Resistance after 1000 hours at 125°C and Resistance to Normal Force at 250g load

Figure 3 clearly illustrates this trend. Utilizing the rough topography of Matte Tin and thickness expected to have good electrical performance a very high R/N value is realized. Insertion force relief can be found in moving to thinner tin but as thickness decreases it becomes important to utilize Olin Advanced Tin™ Barrier (ATB) to ensure low stable contact resistance.

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CHARACTERISTICS AND ATTRIBUTES OF Olin Advanced Tin™ Barrier

Olin Advanced Tin™ Barrier was conceived through surveying the needs of automotive and electronic terminal designers and based on sound metallurgical science. This barrier system is unlike any other and inhibits the diffusion of copper into tin platings better than other commercially available barrier systems. Olin Advanced Tin™ Barrier is highly scalable and enables the use of thinner platings, resulting in lower insertion forces and increased I/O count per connector. Olin's diffusion barrier extends the possibility of using Electro-Tin Reflow and other tin plating systems at Class IV (150°C) automotive service environments. For more information contact Olin Brass at 618-258-5255, Olinbrass.com or email us at info@olinbrass.com.

How Is It Specified

The thickness of Olin Advanced Tin™ Barrier is 10-40 µin or 0.25-1.0 µm, and can be specified under any electro-plated product. However, the use of Reflow Tin is highly recommended to optimize the benefits provided by this plating system. Table 1 contains the minimum recommended guidelines for tin thickness over Olin Advanced Tin™ Barrier in different service environments. Detailed discussion with Olin Market Development Engineering is highly recommended to best optimize the plating system for your application.

Service Environment	Plating System
125°C / 1000 Hours	20 µin Sn
125°C / 3000 Hours	35 µin Sn
150°C / 1000 Hours	40 µin Sn
150°C / 3000 Hours	55 µin Sn

Table 1. Minimum tin thickness when coupled with Olin Advanced Tin™ Barrier at given service environment and time.

Availability

As a global leader in the supply of material systems solutions to the ever expanding world, we strive to ensure the tools are within reach of customer local design and manufacturing centers. Contact Olin in the USA, Wilms in Europe, Olin Asia Pacific in China and SE Asia, and Dowa Metals in Japan. This plating solution is also available on copper alloy wire from Fisk Alloy Wire and Sumco Inc. on post plated bandolier pins. If you have any difficulty obtaining the technical or supply chain information necessary; or would like to review your application in more detail with an Olin Engineer, please contact Olin Market Development Engineering for further assistance.

Olin Advanced Tin™ Barrier: Another Electronics Materials Solution Born of Our Excellence in Materials Research Expertise!

Olin Advanced Tin™ Barrier Products

When ordering the Olin Advanced Tin™ Barrier systems please specify as follows:

"Olin Advanced Tin™ Barrier 0.25-1.0 µm (or 10-40 µin) under (the Electro-Tin plating of your choice)"

Some of the commonly produced plating options include Olin Advanced Tin™ Barrier 0.25-1.0 µm under:	Reasons for Use:
1. 0.5-1.0 µm (20-40 µin) Electro-Tin Reflow, also know by "STAR" - Super Thin Advanced Reflow	Provide lowest insertion forces possible on multi-way connectors in service environments up to USCAR Class Ⅲ - 125°C
2. 1.0-2.0 µm (40-80 µin) Electro-Tin Reflow	Applications requiring more free tin due to contact bump geometry in Class Ⅲ and some Class Ⅳ - 150°C applications
3. 1.9-3.5 µm (75-140 µin) Electro-Tin Reflow	Use as a tin plating solution in applications up to and including Class Ⅳ. Also for use in applications requiring improved contact stability and solderability.
4. Other Electro-Tin plating types and thicknesses can be provided for application specific solutions. Contact Olin Market Development Engineering for more details.	

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