Large Area Bonding Using NanoFoil®

APPLICATION NOTE

Features

- High temperature solders
- Strong metallic bonds
- Bondline control
- Minimal thermal exposure
- In air at room temperature
- Localized heating
- Flux-free
- CTE mismatch not an issue

Introduction

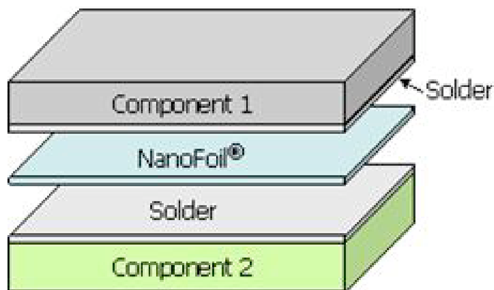
NanoFoil® is a material consisting of hundreds of alternating nanoscale layers of elements such as aluminum and nickel. Once activated, inter-mixing between the alternating metal layers leads to heat generation within the foil. This heat can be used to melt adjoining solder layers and join components together without having to heat the components over the melting point of the solder.

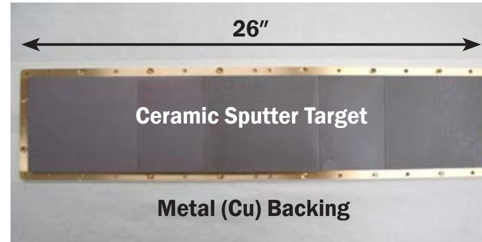
Benefits of NanoBond®

- Bonding with high-melting temperature solders to enable high sputter rates
- Enables bonding of sputter targets to backing plates with very different coefficients of thermal expansion (CTE)
- Low residual stress bonds and significantly better bondline thickness control
- Higher strength bond compared to conventional solder bonds

The NanoBond® Process

To bond sputter targets, **NanoFoil®** is placed between the pre-wet target and backing plate. Pressure is applied to promote wetting during the joining process. The foil is activated with a small local energy pulse at multiple locations using an electrical source. The heat of mixing elements in the foil melts the solder and enables the large area to be bonded with minimal stress.

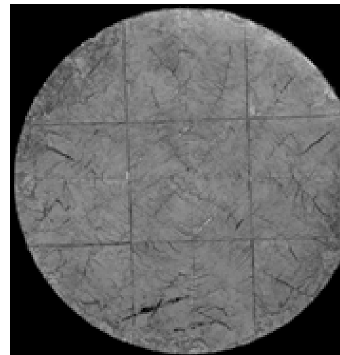




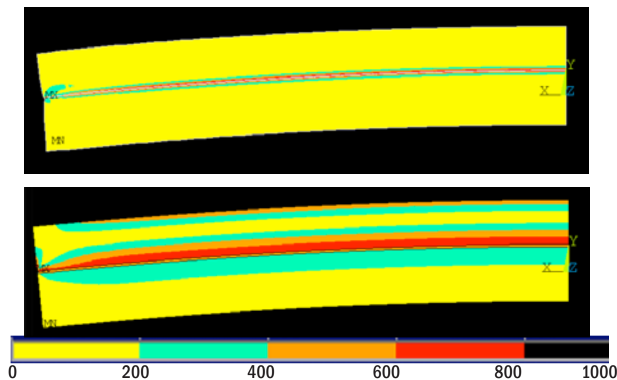
Ceramic target bonded to copper backing plate

Evaluation of NanoBond® Structure and Quality

- Multiple bonds as large as 240 in² made successfully with **NanoFoil®**
- Voiding typically less than 2% over the bonding area
- Bondline thickness control of 0.010 in. or better on 17″-20″ diameter targets



Elastic Strain Energy



FEA modeling of conventional and NanoBond® joints. The strain energy of the NanoBond® joint is ⅛ that of the conventional bond and deflection is an order of magnitude less.

OVER→

Form No. 98782 R0

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Strength

Large area joints are sectioned into smaller pieces for compressive shear testing. The strengths measured for **NanoBond®** joints match or exceed the strengths measured for conventional joints.

Bonding Configuration	NanoBond® Shear Strength (psi)
SnAgSb Bond	9400
SnAgTi Bond	5100
ZnSn Bond	4720
PbSn Bond	3300

Tested on brass-to-brass bonds; applicable to many material combinations, as failure occurs in solder.

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