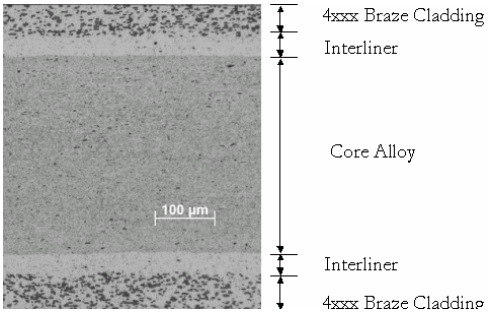
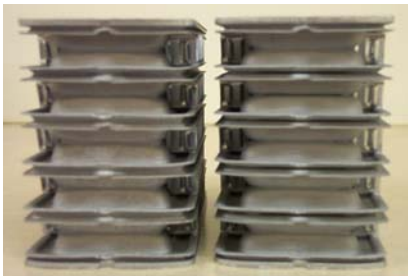
Multi-Layer Clad Products



Multiple cladding layers permit highly-engineered solutions to difficult problems, such as achieving high post-braze strength with CAB-brazed products. Alcoa has developed a variety of four- and five-layer clad products, each exhibiting unique characteristics, depending upon alloy selection and cladding ratio.

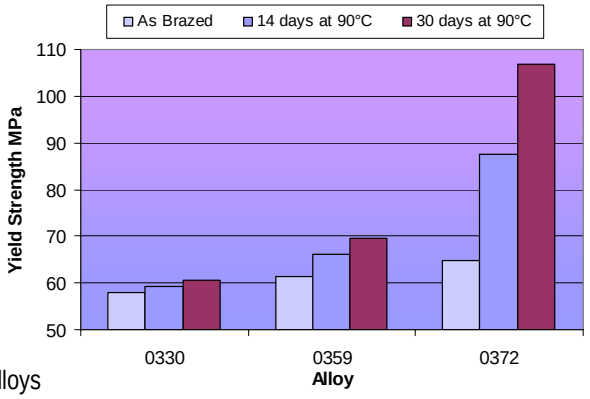
The illustration at left depicts a five-layer clad composite. Material choices determine the characteristics of the composite. For example, the intermediate cladding layers may contain zinc to sacrificially protect the core in a corrosive environment, or the intermediate cladding layers may exhibit excellent inherent resistance to corrosion.

High Strength CAB Applications



With I/L (no skips at 6 g/m^2) No I/L (numerous leaks at 10 g/m^2)

Magnesium is an important element for enhancing the mechanical properties of aluminum alloys. The graph at right shows how the post-brazed mechanical properties rise with increasing concentrations of magnesium in the core alloy. Unfortunately, magnesium interferes with the activity of ("poisons") many commercial fluxes for aluminum brazing.



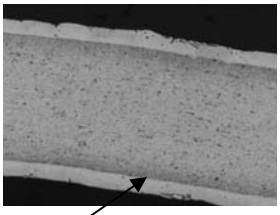
Multiple cladding layers can permit the use of high-strength magnesium-bearing core alloys for CAB applications. Magnesium-free intermediate claddings can serve as barriers to the diffusion of magnesium from a high-strength magnesium-bearing core alloy, and thereby reduce or eliminate "poisoning" the flux.

The photo at left illustrates the magnesium barrier properties of appropriate intermediate cladding layers in CAB environments. The evaporator at far left was fabricated from a five-layer composite with 0.25% magnesium in the core alloy; flux load was 6 grams per square meter. The evaporator at near left was fabricated from a three-layer composite, using the same core alloy as the foregoing five-layer composite; flux load was 10 grams per square meter. Fillets of the evaporator fabricated from the five-layer composite are complete and robust, while the evaporator fabricated from the three-layer composite exhibits numerous incomplete fillets.

Corrosion Resistance

Five Layer 3005 Modified 0359

Alcoa's multiple-layer composites use three corrosion-resistance-enhancing mechanisms to achieve exceptional resistance to perforation by corrosion. Different compositions for the intermediate claddings and the core establish a galvanic potential between the components such that the intermediate cladding layer is anodic to the core. Diffusion of silicon into the core during brazing creates a manganese-depleted zone at the interface between the core and intermediate cladding; this zone is anodic to the remainder of the core. Alcoa's patented (US Patent 4,649,087) elevated titanium concentration in the core alloy reduces intergranular corrosion and promotes lateral corrosion in the core.



$Al_{12}(Fe,Mn)_3$ Si dispersoid band

At left are sample parts that were brazed under typical conditions and subjected to a SWAAT environment for 30 days. The five-layer composite, which included high-purity intermediate claddings, exhibits little attack, while the conventional three-layer "long-life" composites suffered significant deterioration.