

AMAG MultiClad 7020 – the new high-strength brazing material for innovative lightweight solutions

Since the mid-1990s, AMAG rolling has steadily expanded its know-how with regard to high-strength material in combination with functional surfaces and today is regarded as a specialist for heat treatable aluminium alloys.

Cladding for tailor-made applications

Heat treatable alloys are designed specifically for a range of applications by means of cladding on one or both sides, using a functional layer cast from various aluminium alloys. These are exemplified by clad layers for corrosion protection, layers for bright surfaces or cladding with brazing alloys.

This article focuses on the development of a high-strength, heat treatable multilayer solution for lightweight heat exchangers, whereby an innovative material combination offers previously unattainable applications in the aluminium heat exchanger manufacturing sector.

Market demand as the trigger for AMAG developments

In particular, for reasons of strength, the demand of automotive manufacturers for high-performance heat exchangers with a reduced volume and mass, either cannot be achieved, or only to an insufficient extent, using conventional brazing materials. AMAG rolling was prompted by this deficit

to develop a high-strength, multilayer brazing material. Due to its unique mechanical properties this product constitutes a milestone for aluminium heat exchanger manufacturers. As a result of the growing complexity of heat exchangers, higher performance density and the resultant increase in operating pressures, in addition to excellent brazing capacity, cooler manufacturers require good and reproducible processing and forming characteristics, of the delivered semi product, as well as excellent brazing results and high mechanical strength after brazing.

Development success with doubled yield strength

The high-strength MultiClad 7020 brazing material, enables new and innovative heat exchangers with the potential to provide sustainable component and design optimisation, and a reduction in material thickness with a resultant cut in weight and size. The use of AMAG MultiClad technology is the key to opening up high-strength material classes, if conventional clad-

ding technology is employed for heat exchanger material, this merely results in the destruction of the core material during the brazing process. Something that simply does not happen with AMAG MultiClad!

In the 1990s, AMAG developed LongLife (LL) alloys in order to meet the demands for higher strength and improved corrosion resistance prevailing at the time. However, the mechanical characteristics of the LL materials are insufficient for the future stipulations of the automotive industry. Fig.1 shows a comparison of the mechanical properties of AMAG brazing materials. These show that following the brazing process, the Rp 0.2 yield strength for standard 3xxx materials is similar to that of LongLife alloys, while the yield strength for MultiClad 7020 is more than twice as high.

MultiClad – Multilayer compound in a perfect metallurgical combination

Basically, brazing materials consist of a high melting core material and brazing fillers with lower melt temperatures. During brazing, the outer layers should melt and act as an “adhesive” with the neighbouring layer, while the core material remains unaffected. In order to guarantee the latter, the AMAG development team has created a five-layer material combination consisting of high-strength AA7020 core material, the filler material and an additional barrier. Fig. 2 shows the layer structure of MultiClad 7020 in which the interlayer acts as barrier against corrosion and erosion, but also the brazed seam against negative diffusion effects. As a low melting point material, all standard aluminium-silicon alloys can be cladded using both vacuum- and fluxing agent-based processes.

The AMAG 7020 MultiClad is produced by roll bonding. The core ingot is welded

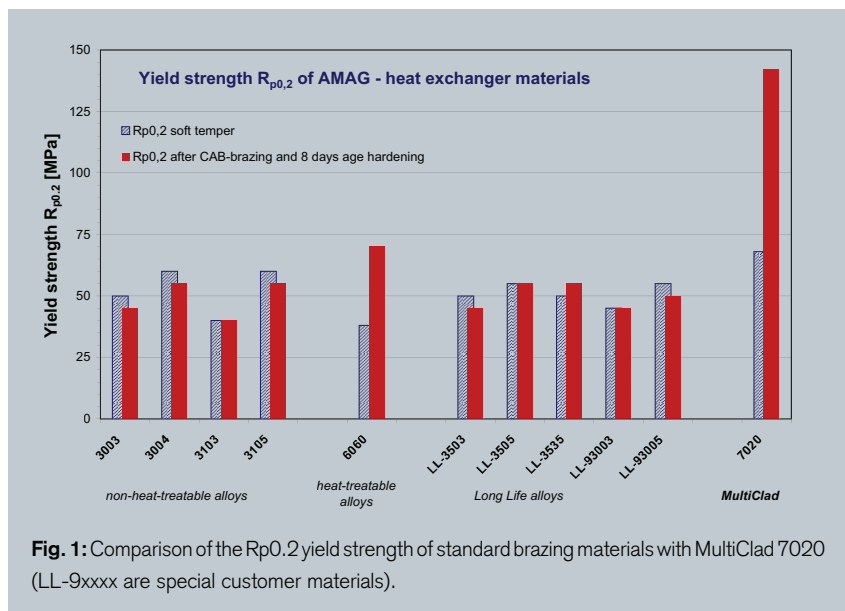


Fig. 1: Comparison of the Rp0.2 yield strength of standard brazing materials with MultiClad 7020 (LL-9xxxx are special customer materials).



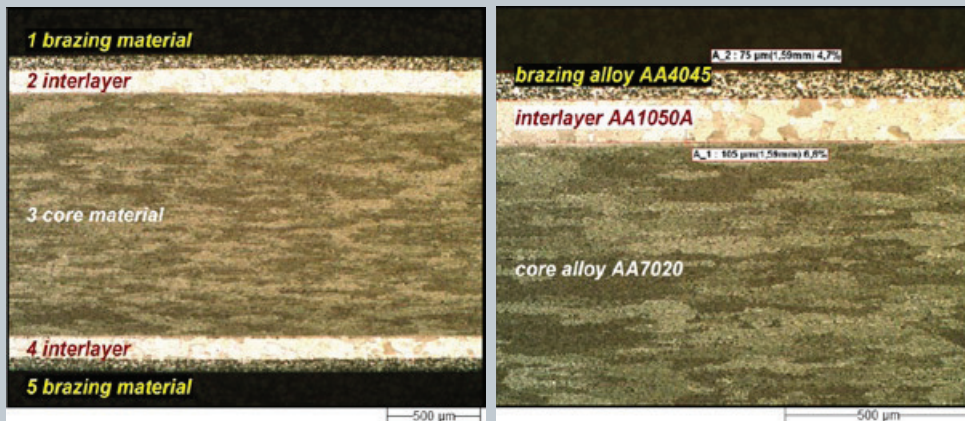
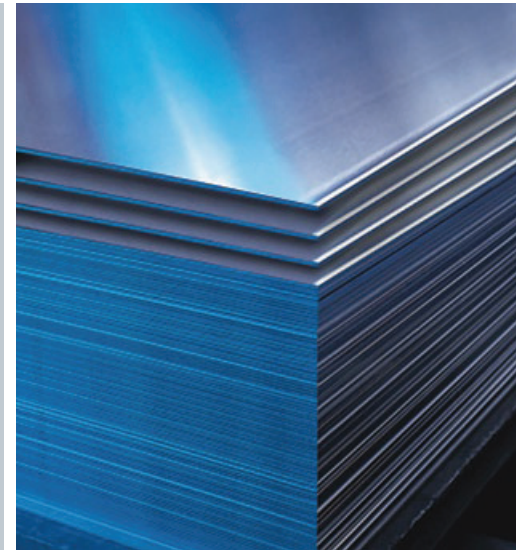


Fig. 2: The 7020 multilayer compound structure



together with the other layers in the cladding station before the material compound gets heated to rolling temperature and metallurgically bonded. To ensure the required cladding the thickness of the welded plates are subject to extremely narrow tolerances. The requirement for the end product with regard to both the sheet and especially the cladding are guaranteed. The material compound resulting from the rolling process possesses a tight metallurgical bonding.

Outstanding characteristics of the EN AW-AlZn4.5Mg1 (7020) core material

The EN AW-AlZn4.5Mg1 (7020) core

material belongs to the heat treatable alloys and, in addition to high static strength, is characterised by excellent weldability and high welded seam strength.

The combination of zinc and magnesium results in a heat treatment ability and thus to strengths that far exceed those of standard brazing alloys. Parallel to joining during the brazing process, solution annealing also occurs at brazing temperature. As shown in Fig. 3, in a soft temper, EN AW-7020 material demonstrates a $R_{p0.2}$ yield strength of around 65 MPa, which after brazing can rise to over 140 MPa due to ageing. While in order to achieve optimum strength, the majority

of heat treatable aluminium alloys have to be subjected to solution annealing in a relatively narrow temperature range. This does not apply to AMAG MultiClad 7020, which has been specially adjusted. Consequently, limited strength due to over-ageing can be excluded. Moreover, the cooling speed following brazing can be varied to a high degree without affecting subsequent cold hardening at room temperature.

Sufficient stability against stress corrosion cracking is achieved by both a sharp delineation between the various alloy components and moderate cooling of the brazing temperature by the customer. ■

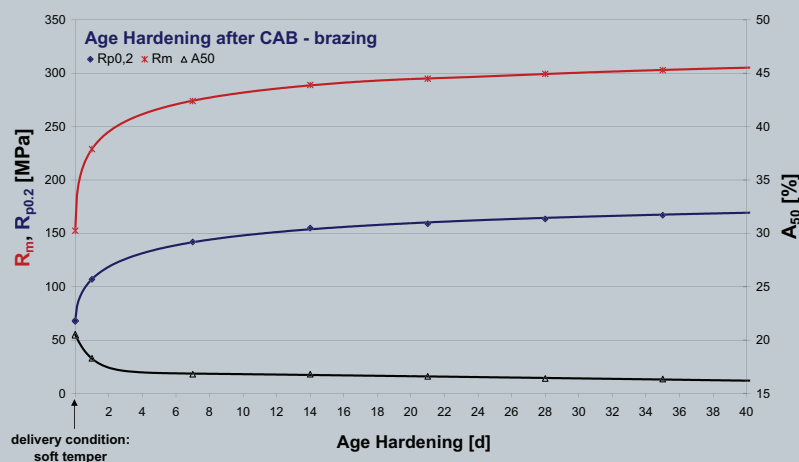


Fig. 3: Hardening progression of 1.6 mm-thick AMAG MultiClad 7020 brazing material following simulated brazing.

SUMMARY

The AMAG MultiClad 7020 system constitutes a quantum leap in the development of heat treatable brazing materials. The manufacturer of heat exchangers is furnished with an opportunity to convert the excellent mechanical properties of AMAG MultiClad 7020 into markedly improved component performance or significant material and weight savings, whereby the use of brazing technology is not limited to heat exchangers.