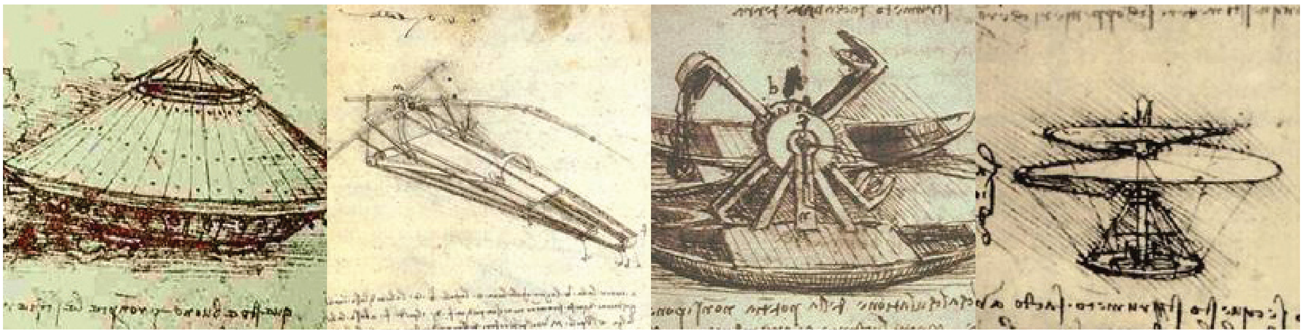
Technology Step Change

Technology Strategy Consultants (*tsc*) promotes thinking and innovation within the aluminium industry.

During the course of our research we often encounter items of interest to the world of semi-fabricated aluminium products, which, on their own, may seem insignificant but, when added together, could be seen as a step-change in their field of technology.



Aluminium Surface Engineering Through Cold Cladding

Many aluminium products customers demand both good mechanical properties, which depend on the bulk material, and also a high level of performance from the surface. Frequently, alloys and process routes are designed to achieve a compromise between these conflicting requirements. Imagine the benefits if both bulk and surface properties could be designed independently. Imagine if the surface of the product could be manufactured in isolation from the bulk, and then the two brought together in the final product. Imagine a product that out-performs the conventional competition, and yet is cheaper to manufacture. If this could be done, what would you make?

Surface critical products

The obvious place to start is with the surface critical products, such as lithographic sheet, anodising quality sheet and bright sheet. All of these currently have to be expensive smelter alloys, in order to achieve their demanding surface properties. The challenge has always been to achieve acceptable mechanical properties without jeopardising the surface. Now imagine instead of a bulk litho alloy made from smelter AA1050, picture a surface layer of AA1050, making up perhaps 10% of the sheet thickness, with a much stronger, remelt-produced alloy core. One current litho sheet ingot would be enough to provide the surface of ten new clad-litho coils. And, of course, the clad-litho could have a much higher level of mechanical performance. The core could also be a sink alloy for just about any scrap.

How about automotive sheet?

Now it gets really interesting! First there is the corrosion performance. Obviously we all know aluminium doesn't corrode. But customers keep designing (unrealistic?) tests, which can suggest otherwise. But an automotive sheet clad with a thin layer of commercial purity aluminium would have unparalleled corrosion resistance. You could even rehabilitate higher strength alloys for automotive applications, which are currently off-limits because of perceived corrosion problems. If that wasn't enough, the surface layer of commercial purity alloy would also result in a marked improvement in formability. Most failures emanate from the free surface during a forming or bending operation, and the cladding alloy is significantly more formable than the bulk. You could probably even relax tight specification limits on impurities in the bulk alloy, allowing for a genuinely more recyclable product.

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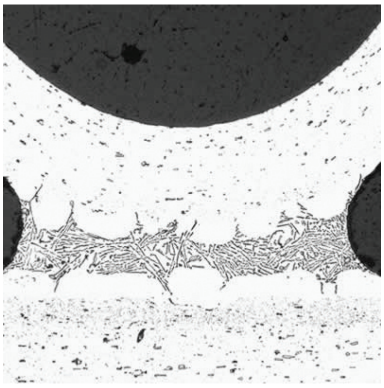
Aluminium Surface Engineering Through Cold Cladding (cont'd)

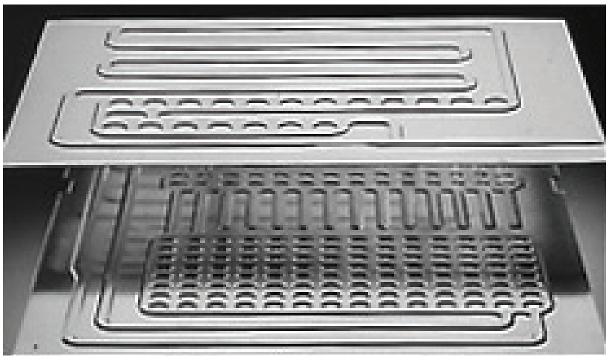
How would you make it?

Think we're dreaming in technicolor? Aluminium brazing sheet has long been manufactured by cladding a low melting aluminium-silicon alloy onto a higher melting core. However, the product is manufactured by roll bonding on a hot reversing mill; a process which is time consuming, and usually plagued by low recoveries. Nevertheless, it provides a good example of the sort of product that can be achieved when the surface is designed and manufactured separately from the bulk. OK, we don't like cladding in the hot mill, so let's do it in the cold mill. The core and cladding alloys can be manufactured independently and efficiently through the hot mill. The surfaces of the core and clad coils will need to be cleaned, before being pack rolled in the cold mill. A few more cold passes, and voilà! - we have a cold clad product. Also notice that we have moved the product differentiation event further downstream, in the best traditions of lean manufacturing.



An example of a braze using clad brazing sheet.

Can it be done?



An example of a roll bonded evaporator panel.

We think it can. Roll bonded refrigeration panels have been manufactured for many years by cold roll bonding. The interface of such a product has areas which are not bonded, to allow subsequent inflation to create coolant channels, and so the bonded areas obviously have good mechanical strength. One final thought, if you divorce the surface from the bulk, it opens up other options. If you are no longer worrying about the surface performance of the core alloy, some traditional constraints begin to evaporate; it could even be continuously cast without stringent compositional limits. Suddenly, products which were the unassailable domain of integrated large hot mills, could be produced more economically. Products with better properties, produced at lower cost, and with shorter lead times. It makes you think, doesn't it?

This "what if" scenario has been brought to you by *tsc* to help relieve us of the here and now and promote thinking and innovation within the industry.

tsc was formed in 2004 by Ricky Ricks and Paul Evans, former research directors for Alcan Rolled Products. We assist clients develop all aspects of their technology strategy, including:

Knowledge Management **Competitive Intelligence** **Technology Development**

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