Fusion technology enables engineers to create aluminum alloy combinations that are no longer cost-prohibitive, or that were not possible via traditional methods.

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The Novelis Fusion process produces aluminum rolling ingots with multiple layers of different alloys (Fig. 1). The multi-alloy ingots are rolled into sheet products with different properties on the outside than on the inside, allowing previously unattainable performance for flat-rolled products. The technology produces an oxide-free metallurgical bond (Fig. 2) between the alloy layers at the molten metal stage, with few restrictions in the range of alloys that can be combined. Proper selection of alloy properties such as hardness or temper and gauge results in products with thickness and functional benefits highly comparable to those of steel — especially compared with single-alloy aluminum products.

The technology provides sheet with formability, dent resistance, durability, and surface finishes that bring aluminum into contention for many automobile components for the first time. Multi-alloy aluminum sheet may now be suitable for applications previously viewed as impractical.

The technology

The Fusion process utilizes a conventional direct-chill mold and starting head, which serve as the primary heat-removing apparatus (Fig. 3). The process also includes a secondary heat-removal apparatus internal to the mold opening. Multiple coolant flows and liquid metal streams are controlled by a series of flow control valves and metal level sensors. These maintain the necessary thermal, structural, and mechanical boundaries during continuous solidification. The secondary heat removal apparatus is typically engineered and manufactured with a curvilinear shape, to compensate for normal contraction during the cast, and to minimize the amount of mixed alloy scrap produced at the edge of the sheet.

The process begins when liquid metal enters the cavity corresponding to the alloy with the highest melting temperature. Metal is allowed to flow for a period of time prior to lowering the starting head. After the starting head is lowered, and before it exits the lower end of the mold, the level of a second stream of metal is raised in the cavity to contact the semisolid interface of the first alloy immediately below the secondary heat removal apparatus. The process is semi-continuous, and produces ingots weighing 12 to 15 tons. These are removed from the casting machine and processed in much the same way as a traditional single-alloy ingot. The ingots are introduced to the rolling mill completely bonded.

No longer are designers restricted to a select group of alloys and dissuaded by the comparative price of steel. They can create alloy combinations that are no longer cost-prohibitive, or that were not possible via traditional methods. Since designers now have the ability to create alloy combinations, they can combine strength, formability, and surface finishes all in one sheet.

Novelis has converted virtually its entire North American production to the Fusion process, thereby proving its viability. The first Fusion facility, located in Oswego, New York, was commissioned in March 2006. Subsequently, Novelis has announced investments in Fusion casting facilities in Switzerland (September 2006) and South Korea (November 2006).

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