Magnesium, Metal of the future: Evolutions in Technology Bring Innovations to Design Applicability of Magnesium Alloy AZ91-D for Rugged Docking Stations

Two hundred years after Sir Humphrey Davy successfully isolated small quantities of magnesium, technologies have begun to successfully match the demands of the rugged mobile computing industry with the metallurgical benefits of the metal. Despite magnesium's abundance, low density and high strength-to-weight ratio, manufacturers needed to address magnesium's corrosion performance and mechanical strength at high temperatures before the metal could be applied to automotive applications.

Evolving Technologies.

There were two key discoveries adapting magnesium to the mobile computing industry starting in the mid 1980s. Dow and Norsk Hydro were able to reduce magnesium alloy's susceptibility to corrosion by reducing the level of impurities in the base alloys. In addition, high temperature die casting alloys with improved mechanical strength at elevated temperatures – specifically AZ91-D – became available. While sand casting of magnesium alloys had been used by the aerospace industry for several years, this process was not suited to the mobile computing industry because of the grainy finish of the product, the high costs associated with machining and finishing, large dimensional variations, and the inefficient use of materials. With the development of high temperature die casting alloys, manufacturers can produce parts with precise detail, fine surface quality, thin walls and excellent dimensional accuracy. This process also allows for cast-in inserts which may reduce the need for secondary machining operations.

Evolving Demand.

Today, consumers demand aesthetically pleasing, cost-effective, high performance docking stations with an eye to environmental awareness and user comfort. High purity magnesium alloy AZ91-D delivers on all fronts.

The low density of magnesium – it is 33 percent lighter than aluminum, an earlier light weight alternative of the automotive industry – and high strength-to-weight ratio, second only to titanium, make it one of the lightest, strongest metals available. This reduces the user's carbon footprint without any loss in performance, durability, impact resistance or strength.

Because of its low density, AZ91-D alloy is easily machined with less waste and energy. The use of die cast magnesium allows for more design freedom compared to traditional docking station materials. This design freedom reduces machining operations and production costs. In addition, if a manufacturer utilizes the hot chamber die-casting method to produce a docking station, the result is greater manufacturing efficiencies, less waste, a faster casting cycle time, and the use of less energy. This cost savings can then be transferred to the end-user in order to provide a cost-effective, durable, high-performance docking station.

Furthermore, magnesium is an excellent "green" option for the mobile computing industry, providing lightweight options that can contribute to a lesser carbon footprint. Magnesium's use has minimal environmental impact and its production exhibits significant energy savings over the manufacture of other metals. In addition, magnesium is abundant – it comprises 2.5 percent of the earth's crust and is the third most abundant dissolved element in seawater. It is readily recyclable, leaving only non-toxic and nonpolluting byproducts. In addition, scrap and components can be recycled to the same high purity and quality standards as primary alloy.

Evolving Designs.

The use of magnesium alloy AZ91-D allows for evolutions in docking station design and improved mounting system and computer performance.

Lightweight advantages. Docking station weight can be cut nearly in half with the use of AZ91-D, resulting in a mounting system that has less mass, which equates to better vibration performance. Vibration is further curtailed by the high energy absorbing properties of AZ91-D. According to the Co-operative Research Centre for Cast Metals Manufacturing, magnesium alloy is significantly better at dampening vibration than aluminum and steel on an equal weight basis. The result is a sturdier mount, decreased wear and tear on the computer and motion attachment, less in-cabin noise, and improved integrity of docking connections.

Rugged resistance. Magnesium alloy is also ideal for the rugged daily use and road conditions that docking stations are exposed to. Magnesium alloy AZ91-D combines the best characteristics of magnesium (proportionate strength, malleability, conductivity and dimensional stability) with the corrosion resistance and strength of aluminum and zinc. This extremely strong, yet light, alloy does not lose its shape under stress, has a greater stiffness and is highly dent and impact resistant.

Thin gage benefits. Because of its high strength-to-weight ratio, thinner gages can be used in the manufacturing of a docking station without the alloy losing its ruggedness and without the need

for layering as required by other metals. Because thin gage magnesium alloy remains resistant to denting and bending, it is much easier to work with and contributes to design simplification. The design needn't be fortified in order to make it rugged.

A further benefit of thin gage construction is its ability to block electro magnetic interference (EMI) that disrupts communication. While most alloys are inherently conductive and shield out EMI, AZ91-D has a distinct advantage over most other alloys because of its fluidity – the thinner the gage, the better it blocks higher frequency EMI used for commercial applications.

Fluid, exacting tolerances. Docking stations can also be die cast in one piece to very exacting tolerances because of AZ91-D's high fluidity and superior dimensional stability. The alloy can be cast in very intricate geometric structures. The result is a docking station with improved reliability, fewer joints and external components, and reduced waste from the die cast processing.

Integrating docking station and rugged computer design. Because of its high thermal conductivity, magnesium alloy docking stations readily and effectively dissipate heat generated by laptop computers that can be harmful to the laptop computer. Last, magnesium has a better surface finish than plastic molded parts and a smooth surface that not only gives docking stations a rich finish, but allows for user comfort with rounded edges and sleek design.

Evolving Direction, Evolving Options.

With new technologies come new choices for the consumer. It is important that suppliers conduct thorough engineering, materials, design and production methods to bring about an evolution in design that benefits the consumer without additional cost. It is just as important that suppliers remain versatile and innovative – staying ahead of customer needs by keeping pace with advancing technologies that will benefit the customer. It is imperative that suppliers design and produce docking stations that meet FCC and MIL-STD-810F standards.

By capitalizing on the metallurgical techniques that have made high purity magnesium alloys available to the mobile computing industry, providers of docking stations can offer high performance, cost-effective, environmentally conscious solutions to the end user that are lightweight, rugged, impact and dent resistant. These solutions also provide an enhanced user experience, improve communications and better protect the components housed within.