Rare Earth In Application Of Magnesium Alloy

The beneficial effects of rare earth on the non-ferrous materials in the magnesium alloy is the most obvious. Appropriate content of rare earth can refine the grain size of magnesium and magnesium alloys.The first is to refine casting grain. Rare earth elements refine the mechanism is not the role of heterogeneous nucleation of magnesium alloy casting organizations. The mechanism of rare earth elements on the grain refinement of magnesium and magnesium alloy crystallization forefront of undercooling increases.

Purification Of Rare Earth Magnesium Alloy Melt Role

The affinity of the REE and itch is greater than the affinity of the magnesium and oxygen, it can be generated with the MgO and other oxides in the melt reaction of rare earth oxides anc precipitate to remove oxide inclusions. React with hydrogen and water vapor in the melt and generate cyanide or rare earth oxides to achieve the purpose of phenylephrine. Also can increase the melt flow and reducing the casting shrinkage, increase compactness.

Improve Alloy Strength At Room Temperature The Role Of Rare Earth Magnesium Alloy

Majority of rare earth elements in solid solution in magnesium, and reduce the solid solubility of marked changes in temperature, rare earth elements in addition to solid solution strengthening, or a magnesium alloy aging strengthening elements, some of the rare-earth compounds, dispersion strengthening role.

magnesium alloy processing plant

Rare Earth Magnesium Alloy To Improve The Thermal Stability Of The Role Of The Mechanical Properties

Rare earth elements is the most effective alloying elements improve heat-resistant magnesium alloy can significantly improve the strength of the Mg alloy high temperature and high temperature creep resistance, the reason is manifold: rare earth magnesium diffusion coefficient, can slow down and then crystallization process and the recrystallization temperature,increase the aging effect and precipitation relative to the thermal stability of rare earth compounds of high melting point grain boundary pinning,impede dislocation movement to improve the high temperature creep resistance.

In addition to the above-described rare earth magnesium alloy,rare earth alloy corrosion performance can be improved due to the purification of the melt,reducing the impurities of iron and other harmful effects,thereby enhancing the corrosion resistance.

Specifications

Magnesium alloy with Rare Earth Elements has good mechanical properties.
Magnesium - Rare Earth Alloy

Our company R&D the magnesium based Rare Earth Alloys as follows. They are widely used for aviation, aerospace, machinery, power plant, auto and railway.

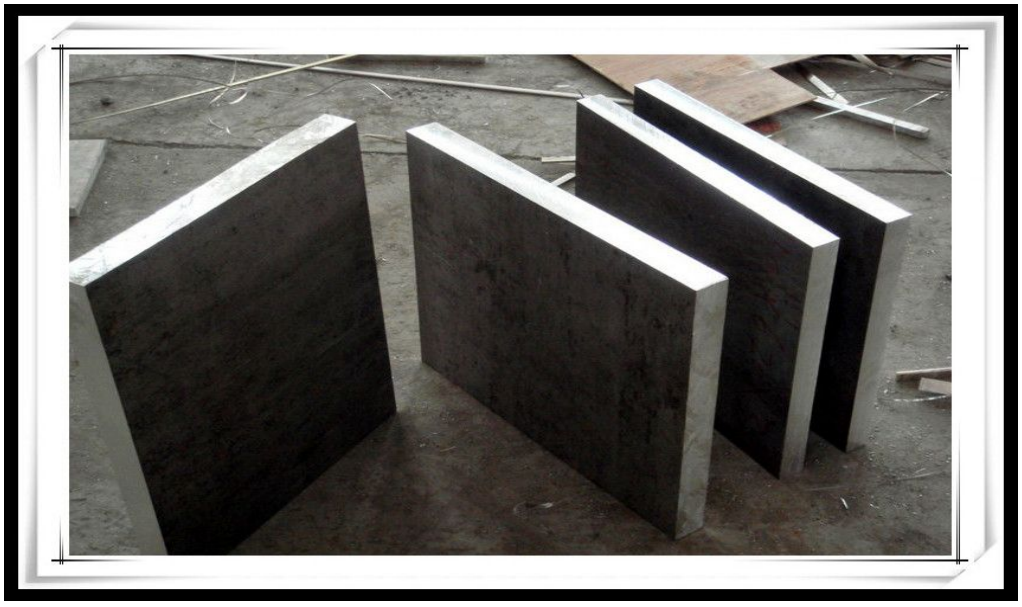
Name	Alloy Grade	Main alloy content (%)	Specification	Inclusion (%)	Form
Mg-Nd Alloy	Mg-Nd25	Nd: 25±2%	HB7264-96	As per HB7264-96	Square
	Mg-Nd30	Nd: 30±2%	HB7264-96		
Mg-Zr Alloy	Mg-Zr25	Zr: 25±2%	HB6773-93	As per HB 6773-93	Square, round bar
	Mg-Zr30	Zr: 30±2%	HB6773-93		
	Mg-Zr40	Zr: 40±2%	HB6773-93		
Mg-Sc Alloy	Mg-Sc	Sc: 2%~10%		As per customer requirement	Square, round bar
Mg-Y Alloy	Mg-Y	Y: 20%~70%	High purity	Less than 100ppm	Round bar
Mg-Gd Alloy	Mg-Gd	Gd: 20%~70%	High purity	Less than 100ppm	Round bar

Product Name	Rare earth element content
Mg-Neodymium Alloy	(5%-35%) Neodymium
Mg-Gadolinium Alloy	(5%-30%)Gadolinium
Mg-Yttrium Alloy	(5%-30%) Yttrium
Mg-Ytterbium Alloy	(5%-30%) Ytterbium
Mg-Dysprosium Alloy	(5%-30%) Dysprosium
Mg-Erbium Alloy	(5%-30%) Erbium
Mg-Lanthanum Alloy	(5%-30%) Lanthanum
Mg-Cerium Alloy	(5%-30%) Cerium
Mg-Lanthanum-Cerium Alloy	According to user's requirements
Mg-Praseodymium-Neodymium Alloy	According to user's requirements
Mg-La-Ce-Pr-Nd Alloy	According to user's requirements
Mg-Gd-Nd Alloy	According to user's requirements

The quality standard is subject to Air Standards.Performance : They are used in casting and wrought magnesium alloy containing rare earth. It can obviously enhance alloys resistance to elevated temperatures, corrosion resistance and creep resistance.Meanwhile, it can refine the microstructure of alloy and observably improve the strength, casting property and process ability of alloy.Impurity content: the proportion of single rare earth element to total rare earth in the magnesium-rare earth alloy is above 99.9% , the impurity content(wt%):Fe≤0.003, Si≤0.01,Cu≤0.005,Ni≤0.001,Al≤0.01,Co≤0.0001.The shape and packaging of the products are according to user's requirements.The content of main rare earth elements of master alloy is no less than the value of user requirement.

Other Magnesium based Alloys:
AE811S, ZE41A, WE43, WE43A
Mg-La Alloy; Mg-Sb Alloy; Mg-Ce Alloy; Mg-Sr Alloy; Mg-Er Alloy; Mg-Sn Alloy; Mg-Yb Alloy; Mg-Ir Alloy; Mg-Dy Alloy; Mg-In Alloy; Mg-Re; Mg-Ti; Mg-Re (La); Mg-Co; Mg-Mn; Mg-Si; Mg-Ca; Mg-V; Mg-Fe; Mg-Zn; mg-Ni; Mg-Al-Sc; Mg-Cu; Mg-Y-Ni; Mg-Al; mg-Al-Zn.

Photo:



Usage: Cars Wheel Hub, Glasses Frame, Coal-fired plant, Nuclear power plant, and digital products(like Cellphone&PC frame).

Potential:

1 .Bicycle Frames of Rare Earth Magnesium Alloy & Magnesium Alloy Wheel Chair

Good plasticity and unique shock absorption which is 6-10 times that of aluminum alloy

Such kind of frames are featured by light weight (similar to carbon fiber but less expensive), high strength (similar to aluminum alloy and twice that of steel), good plasticity and unique shock absorption which is 6-10 times that of aluminum alloy. Using bicycle frames can make riding more comfortable and reduce greatly sports hurt.

2.Rare Earth Metals as Alloying Components in Magnesium Implants for Orthopaedic Applications

FIGURE 1.

X-ray depiction of an implanted MA-pin with marked μ-CT scan area.

The usual addition of Rare Earths (RE) in engineering applications is performed as mischmetal or didymium, whereof the mischmetal contains 50 wt% cerium and the rest principally neodymium and lanthanum. REs aim to increase the strength of Magnesium Alloy and to decrease weld cracking and porosity during the casting procedure .

Regarding the development of implant material it is important, that the addition of RE can achieve an increase of the corrosion resistance. However, this also depends on the other alloying elements.

3.Scientists develop heat-resistant magnesium alloys for aircraft

Magnesium alloys are very attractive in such applications as automotive, railway and aerospace technologies. However, their low ignition temperatures (470~550 deg C) and low mechanical strength have restricted their use. The ignition temperature has been improved to approximately 620~810 deg C by developing Ca-added, CaO-added and (Ca and Y)-added alloys;; however, their mechanical properties are inferior to those of aluminum alloys. Recently, we have developed two types of flame-resistant magnesium alloys with high strength.

4.Rare earth Magnesium alloy cylinder head born successfully

Magnesium alloy is light, less noisy and easy-cast, and named as the Green metal in the 21stcentury and an alloy best substituting for aluminum. It is used in transportation, manufacturing, 3G electronics, aviation and aerospace industries worldwide. So far, magnesium alloy components being applied and developed are over 60 kinds in Europe, over 100 kinds in North America.

Appendix :New Flame-resistant Magnesium Alloys

(1) LPSO-type Mg Alloys (KUMADAI Heat-resistant Mg Alloys)

LPSO-type Mg alloys are duplexes of α-Mg phase and a novel phase with a long period stacking ordered (LPSO) structure. The LPSO structure is formed in Mg-M-RE alloys, in which the M element is Co, Ni, Cu, Zn or Al, and the RE (rare earth) element is limited to Y, Gd, Tb, Dy, Ho, Er or Tm. The LPSO-type Mg alloys are called “KUMADAI heat-resistant Mg alloys”, in which “KUMADAI” means Kumamoto University in Japanese. The LPSO-type Mg alloys produced by extrusion of cast ingots have high yield strength (350-520 MPa for 0.2% proof strength) and reasonable elongation (5-15 %) at room temperature, and high elevated-temperature yield strength (250-350 MPa at 473 K). These mechanical properties are superior to those of ordinal magnesium alloys such as AZ91, and high strength aluminum alloys such as super duralumin and extra-super duralumin. The LPSO-type Mg alloys produced by rapidly solidified powder metallurgy (RS P/M) processing exhibit higher mechanical properties and corrosion resistance than the LPSO-type Mg alloys produced by ingot metallurgy (I/M) processing. A RS P/M $Mg_{96.75}Zn_{0.75}Y_2Al_{0.5}$ alloy has tensile yield strength of 533
MPa, tensile elongation of 10.6 %, and fatigue strength (107
cycles) of 325 MPa. Its
specific yield strength and specific fatigue strength and corrosion resistance are 1.6, 1.7 and 2.8 times as high as those of extra-super-duralumin (7075-T6). The ignition temperature of the LPSO-type Mg alloys is ranging from 780 to 940 deg C, which is much higher than that of ordinary magnesium alloys.

(2) C36-type Mg Alloys (KUMADAI Non-flammable Mg Alloys)

C36-type Mg alloys, which contains no rare metals, are called “KUMADAI non-flammable Mg alloys”. These alloys are consisted with α-Mg phase and C36-type intermetallic compounds. The C36-type intermetallic compound is easily dispersed in α-Mg matrix by extrusion, resulting in good ductility. The C36-type Mg alloys produced by extrusion of cast ingots have high yield strength (410~460 MPa for 0.2% proof strength) and reasonable elongation of 3.5% at room temperature. Their ignition temperature exceeds the boiling point of pure magnesium (1,091 deg C).

(3) FAA Flammability Test

FAA Technical Center has carried out the flammability tests on KUMADAI heat-resistant Mg alloy and KUMADAI non-flammable Mg alloy. The rectangular bar samples with a 0.25 inch thickness, a 1.5 inch height and 20 inch length were used for the flammability tests. The bar sample was exposed to oil fired burner flame for 4 minutes. The flammability test was carried out 6 times for each alloy. All samples passed the test very easily, with essentially no burning at all.

3. Conclusions

We have developed two types of new magnesium alloys with high strength and high ignition temperature. These alloys passed the FAA flammability test easily, with essentially no burning at all. These alloys enable us to expand the application field, to reduce the production costs, and to improve the safety of materials production and working.