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A Mini Review on Applications and Uses of Alloys

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ABSTRACT

Alloys are mixed of metal with other metal or non-metal in the same group that are prepared by mixing of the metals in their molten state through physical processes. An alloy is a mixture of two elements, one of which is a metal. Alloys often have properties that are different to the metals they contain. This makes them more useful than the pure metals alone. For example, alloys are often harder than the metal they contain.

Keywords: alloy properties, hardness and strength, metals combination, mixture of elements, physical and chemical properties

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INTRODUCTION

Alloys are metallic substances composed of a mixture or metallic solid solution of two or more metals. They can even be composed of a metal and another element which may be non-metallic to produce an alloy. An alloy usually has different properties from the elements that it is composed of. A variation in the concentration and ratios of elements produces alloys with different properties. They can be classified into two types, substitutional or interstitial alloys which difference depends on the arrangement of the atoms that make up them. There are several combinations of alloys which can be achieved by combining different metals or elements to have different properties and serve different functions. The uses of alloys are vast, and they can be manipulated to serve different functions by combining metals to produce alloys with specific properties ideal for the application. The use of alloys is vast in several different industries, ranging from military and medical equipment to commercial and industrial materials. Some examples of alloys are copper, stainless steel, aluminum and bronze, with each of them having different properties [1].

Alloys have been around for a very long time, even before modern technology. However, the progress in alloy technology only occurred in the last few decades. Copper was the first metal to be extracted from an ore and it was later combined with tin to create bronze. Today there are several combinations of alloys that serve different needs and functions. In this form of merger, the metals are not made to chemically bond with one another but are simply mixed together to achieve certain properties. Alloys made out of the combination of copper and zinc is known as brass. These alloys are a type of decorative metal that are used to make musical instruments.

Even gold and silver that are used to make jewelry do not usually contain pure gold or silver but have a certain percentage of copper or other metals to provide the jewelry with longer lasting properties. Also, when iron is extracted from its ore, it produces alloys that have varied in amount of carbon [1].

Preparation of Alloys

Put the alloy, a piece of tin and a piece of lead into a sand tray. All three samples should be the same distance from the middle of the dish. Heat the dish gently in the middle. When two of the metals have melted, stop heating. Alloys can be made by combining two or more metal elements while in a molten state or by bonding metal powders [1, 2]. Alloys can be made through physical processes and determining physical and chemical properties. It is made up of two or more chemical elements, of which at least one is a metal. An alloy has properties different from the metals it is made of. Most alloys are made by melting the metals, mixing them while they are liquid to form a solution, then leaving them to cool and turn solid again [2].

Purpose of Making Alloys

The aim of making alloys is to enhance the hardness of a metal. An alloy is harder than its components. Pure metals are generally soft. The hardness of a metal can be enhanced by alloying it with another metal or nonmetal. Alloys increase the hardness and strength of a metal and prevent corrosion or rusting. It also improves the appearance of metal surface [2].

Types of Alloys

- Bearing alloys: It is being used for accommodating enough pressure under sliding contact with another metal body commonly known as rotating shaft of the motor, generator, vehicles and various types of propellers.
- Corrosion-resisting alloys: Noble metal uses to make corrosion-resistant alloys which initially oxidized and act as separation layer preventing chemical action from other materials or corrosive environment. Stainless steel and aluminum alloy are examples of these alloys.
- Super-austenitic stainless steels alloy (SASS Alloy): During the last decades of the 20th century, stainless steel technology took a giant leap forward with the development of higher nickel stainless steels enhanced by the addition of nitrogen for improved strength and corrosion resistance. These alloys normally contain about 6% molybdenum, so they offer excellent resistance to localized corrosion in reducing and mixed acid environments. They contain sufficient chromium for resistance to oxidizing environments as well.
- High-strength corrosion-resistant alloys: Offers corrosion-resistant alloys that are essentially precipitation-hardenable (age-hardenable) versions of their solid-solution counterparts. These products offer the corrosion resistance of the standard alloys but more than twice the strength. In addition, precipitation-hardenable alloys can be fabricated prior to heat treatment when they are relatively soft and ductile and then heat treated afterword to develop high strength.
- Steel alloys: combining iron and a small amount of carbon gives variety of steel products. To make different quality of steel alloys, we add molybdenum, nickel, silicon, boron and manganese.
- Other alloys are dental alloy and die-casting alloy which are widely used in our daily life.

Properties of Alloys

Various alloys have different properties like strength, malleability, visual attractiveness, conduct electricity, durability, resistance of corrosion, ability to withstand heat, etc. Copper and tin uses to make Bronze, an important alloy harder than copper. This quality has been utilized for imprint the civilization and history of mankind for thousands of years called bronze age. In our daily life, mankind uses alloys in almost all of the fields that use metals. Most known elements have involvement in making alloys thus we

have tens of thousands of alloy products. Alloys are attractive due to its improved quality for make utilizing the pure elemental metals [3].

Industrial Application of Alloys

Main metals in alloys are magnesium, copper, aluminum, steel, nickel, titanium, steel, and nickel. Alloy materials have very important role in our daily life [4].

Uses of |Magnesium Alloys

Magnesium alloys are in use around the world in a variety of different applications. They are a preferred material when looking for weight reduction without compromising overall strength. The vibration damping capacity is also beneficial in applications in which the internal forces of high-speed components must be reduced. The most common applications are:

- Aircraft and missile components
- Aircraft engine mounts, control hinges, fuel tanks, wings
- Automotive wheels, housings, transmission cases, engine blocks
- Bicycles and other sporting equipment
- Equipment for material handling
- Ladders
- Laptops, televisions, cell phones
- Luggage
- Portable power tools, chainsaws, hedge clippers, weed whackers
- Printing and textile machinery
- Steering wheels and columns, seat frames
- Magnesium alloys have also been used as a replacement for some engineering plastics due to their higher stiffness, high recycling capabilities and lower cost of production.

Uses of Titanium Alloys

Titanium alloys are metals that contain a mixture of titanium and other chemical elements. Such alloys have very high tensile strength and toughness (even at extreme temperatures). They are light in weight, have extraordinary corrosion resistance and the ability to withstand extreme temperatures. However, the high cost of both raw materials and processing limit their use to military applications, aircraft, spacecraft, medical devices, highly stressed components such as connecting rods on expensive sports cars and some premium sports equipment and consumer electronics. Although "commercially pure" titanium has acceptable mechanical properties and has been used for orthopedic and dental implants, for most applications titanium is alloyed with small amounts of aluminum and vanadium, typically 6% and 4%, respectively, by weight. This mixture has a solid solubility which varies dramatically with temperature, allowing it to undergo precipitation strengthening. This heat treatment process is carried out after the alloy has been worked into its final shape but before it is put to use, allowing much easier fabrication of a high-strength product [5].

Uses of Aluminum Alloys

Just like other metal alloys, aluminum alloys gain strength and specific characteristic after they are produced from the merger of aluminum with other elements. Properties such as light weight and great strength allow aluminum to be used in several different industries. Applications of aluminum include transportation, electrical applications, construction and medicine. High altitude flying would not have been possible without aluminum as it possess properties that can withstand high pressures. It is useful in the construction of homes and furniture, in alumina refining and also in recycling [5].

Uses of Copper Alloys

Possessing properties such as high corrosion resistance, ductility, low cost and electrical and thermal conductivity, copper alloys are used vastly

in manufacturing electrical equipment. They are commonly used for heat exchangers as they can conduct thermal energy efficiently. Their low cost allows them to be used for making several electrical appliances in the industry. It is useful in corrosion resistance of materials, in sleeve bearing due to its strength and in all types of electrical equipment [6].

Uses of Nickel Alloys

Used in applications such as aircraft turbine engines, nuclear power plants and many chemical and petrochemical industries, nickel alloys have contributed to today's economy greatly. These alloys have great corrosion and heat resistance and are commonly used in control equipment to determine the base electrical characteristics of that equipment [5, 6].

Uses of Stainless Steel Alloys

One of the most vastly used alloys; steel is a combination of iron with a small amount of carbon, which gives the alloy a different type of crystal arrangement within allowing the crystal layer to slide past one another and thus giving the alloy properties like resistance to oxidation and strength. Stainless steel alloys are also vastly used in many industries. Their key property to resist corrosion and rusting allow them to be used in applications at the bottom of the sea. Commercial applications of these alloys include cutleries and watch straps. In the manufacturing industry, stainless steel alloys are used to make electronic agricultural materials [7].

Other Applications of Alloys is in Dentistry Uses. It is useful in removable partial denture framework, full denture bases, Crown and bridge and dental implants [8].

CONCLUSION

Alloys are very important and play a very significant role in military, aircrafts, commercial, industrial, and manufacturing applications. Industrial of making coins, turbines, pipes and blades, jewelry, uses in structural materials, and in automobile industrial.

REFERENCES

[1] C. Hunter. *Aluminum Building Wire Installation and Terminations, IAEI News*. January–February 2006. Richardson, TX: International Association of Electrical Inspectors; 2006.

[2] Hausner. *Beryllium Its Metallurgy and Properties*. University of California Press; 1965.

[3] Ultimet® alloy – Nominal Composition. Haynes International. Retrieved October 4, 2016.

[4] Tin Based Alloys. Mayer Alloys.

[5] M.K. Kulekci. Magnesium and its alloys applications in automotive industry, *Int J Adv Manuf Technol*. 2008; 39(9-10): 851–65p.

[6] http://www.lopol.org/.

[7] http://ruthtrumpold.id.au/.

[8] http://link.springer.edu/ 21.