Angular Momentum of Switzerland

„aer aeris“

The Bronze Collection

BRONZE „aer aeris“
an extraordinary material

June 1st 2010, Angular Momentum has introduced its first BRONZE timepiece the Freehand Beryllium Diver Magnus, which has been published in all relevant magazines and media. After many tests and investigations Angular Momentum has decided to integrate the material bronze in its collection and to develop a specific Bronce Collection. Respectively to offer all timepieces not only in all golds, Platinum or 1.4435Cnu steel but also in Silicon Bronce, the most suitable and hardest among the Copper alloys.

Bronze is a metal alloy consisting primarily of copper, usually with tin as the main additive, but sometimes with other elements such as phosphorus, manganese, aluminum, or silicon. It is hard and brittle, and it was particularly significant in antiquity, so much so that the Bronze Age was named after the metal. However, since „bronze“ is a somewhat imprecise term, and historical pieces have variable compositions, in particular with an unclear boundary with brass, modern museum and scholarly descriptions of older objects increasingly use the more cautious term „copper alloy“ instead.

The word Bronze is believed to be cognate with the Italian: bronzo and German: brunst, perhaps ultimately taken from the Persian word birinj („bronze“) or possibly from the Latin name of the city of Brindisi (aes Brundusinum—Pliny).

History

The discovery of bronze enabled people to create metal objects which were better than was previously possible. Tools, weapons, armor, and various building materials, like decorative tiles, made of bronze were harder and more durable than their stone and copper („Chalcolithic“) predecessors. Initially bronze was made out of copper and arsenic to form arsenic bronze. It was only later that tin was used, becoming the sole type of bronze in the late 3rd millennium BC. Tin bronze was superior over arsenic bronze in that the alloying process itself could more easily be controlled (as tin was available as a metal) and the alloy was stronger and easier to cast. Also, unlike arsenic, tin is not toxic.

The earliest tin-alloy bronzes date to the late 4th millennium BC in Susa (Iran) and some ancient sites in Luristan (Iran) and Mesopotamia (Iraq).

Copper and tin ores are rarely found together (exceptions include one ancient site in Thailand and one in Iran), so serious bronze work has always involved trade. In Europe, the major source for tin was Great Britain‘s deposits of ore in Cornwall, which were traded as far as Phoenicia in the Eastern Mediterranean.

Though bronze is generally harder than wrought iron, with Vickers hardness of 60–258 vs. 30–80, the Bronze Age gave way to the Iron Age; this happened because iron was easier to find. Bronze was still used during the Iron Age, but, for many purposes, the weaker wrought iron was found to be sufficiently strong. Archaeologists suspect that a serious disruption of the tin trade precipitated the transition. The population migrations around 1200–1100 BC reduced the shipping of tin around the Mediterranean (and from Great Britain), limiting supplies and raising prices. As ironworking improved, iron became cheaper; and as cultures advanced from wrought iron to forged iron, they learned how to make steel, which is stronger than bronze and holds a sharper edge longer.

Composition

There are many different bronze alloys but modern bronze is typically 88% copper and 12% tin. Alpha bronze consists of the alpha solid solution of tin in copper. Alpha bronze alloys of 4–5% tin are used to make coins, springs, turbines and blades. Commercial bronze (90% copper and 10% zinc) and Architectural bronze (57% Copper, 3% Lead, 40% Zinc) are more properly regarded as brass alloys because they contain zinc as the main alloying ingredient. They are commonly used in architectural applications. Bismuth bronze is a bronze alloy with a composition of 52% copper, 30% nickel, 12% zinc, 5% lead, 1% bismuth. It is able to hold a good polish and so is sometimes used in light reflectors and mirrors.
Other bronze alloys include aluminum bronze, phosphor bronze, manganese bronze, bell metal, speculum metal and cymbal alloys.

The alloy Angular Momentum has chosen aftre tests and investiogations is the Silicon Bronce

Properties

Bronze is considerably less brittle than iron. Typically bronze only oxidizes superficially; once a copper oxide (eventually becoming copper carbonate) layer is formed, the underlying metal is protected from further corrosion. However, if copper chlorides are formed, a corrosion-mode called „bronze disease“ will eventually completely destroy it. Copper-based alloys have lower melting points than steel or iron, and are more readily produced from their constituent metals.

They are generally about 10 percent heavier than steel, although alloys using aluminum or silicon may be slightly less dense. Bronzes are softer and weaker than steel—bronze springs, for example, are less stiff (and so store less energy) for the same bulk.

Bronze resists corrosion (especially seawater corrosion) and metal fatigue more than steel and is also a better conductor of heat and electricity than most steels. The cost of copper-base alloys is generally higher than that of steels but lower than that of nickel-base alloys.

Copper and its alloys have a huge variety of uses that reflect their versatile physical, mechanical, and chemical properties. Some common examples are the high electrical conductivity of pure copper, the excellent deep drawing qualities of cartridge case brass, the low-friction properties of bearing bronze, and the resistance to corrosion by sea water of several bronze alloys.

The melting point of Bronze varies depending on the actual ratio of the alloy components and is about 950 °C.

Hardness

Silicon Bronze 200-230 HV (Vickers)
316L Stainless steel 190-210 HV (Vickers)
Titanium grade 5 150-190 VH (Vickers)
Titanium Grade 5 cold formed 250-300 HV (Vickers)
White gold 150 - 180 HV (Vickers)
Diamond 10.060 HV (Vickerts)

Uses

Bronze was especially suitable for use in boat and ship fittings prior to the wide employment of stainless steel owing to its combination of toughness and resistance to salt water corrosion. Bronze is still commonly used in ship propellers and submerged bearings.

In the twentieth century, silicon was introduced as the primary alloying element, creating an alloy with wide application in industry and the major form used in contemporary statuary. Aluminum is also used for the structural metal aluminum bronze.

It is also widely used for cast bronze sculpture. Many common bronze alloys have the unusual and very desirable property of expanding slightly just before they set, thus filling in the finest details of a mold. Bronze parts are tough and typically used for bearings, clips, electrical connectors and springs.

Spring bronze weatherstripping comes in rolls of thin sheets and is nailed or stapled to wood windows and doors. There are two types, flat and v-strip. It has been used for hundreds of years because it has low friction, seals well and is long lasting. It is used in building restoration and custom construction.

Bronze also has very little metal-on-metal friction, which made it invaluable for the building of cannon where iron cannonballs would otherwise stick in the barrel. It is still widely used today for springs, bearings, bushings, automobile transmission pilot bearings, and similar fittings, and is particularly common in the bearings of small electric motors. Phosphor bronze is particularly suited to precision-grade bearings and springs. It is also used in guitar and piano strings.

Unlike steel, bronze struck against a hard surface will not generate sparks,

so it (along with beryllium copper) is used to make hammers, mallets, wrenches and other durable tools to be used in explosive atmospheres or in the presence of flammable vapors.

Industrial uses

Phosphor bronze is used for springs, bolts and various other items used in situations where resistance to fatigue, wear and chemical corrosion are required e.g. ship‘s propellers in a marine environment. The alloy is also used in some dental bridges.

Grades A, C and E – C51000, 52100, 50700 are commonly used nonferrous spring alloys. The combination of good physical properties, fair electrical conductivity and moderate cost make Phosphor Bronze round, square, flat and special shaped wire desirable for many springs and electrical contacts and a wide variety of wire forms where cost of properties does not prescribe Beryllium copper.

Mediacl aspects

Copper and its alloys show a long history of medicine as a therapeutic. Already 4000 years ago the Egyptians used the antiseptic effect from copper and used copper filings, mixed with cow‘s fat and honey, for the sore healing. Hippokrates, the forefather of all doctors, treated ulcers and varicose veins with the mineral substance, while the Swiss doctor and philosopher Paracelsus used copper even with insanities, epilepsy and hysteria. And in old China one was persuaded of the bactericidal effect of the copper so much that one forbade the use of paper money and prescribed for it the payment with copper money to prevent the propagation of certain illnesses. Also in other cultures copper coins have been introducedfor similar reasons.

Bronze Timepieces

Each Bronce timepieces is completely manufactured in the Angular Momentum Ateliers. The manufacturing process includes turning and milling on conventional hand operated high-precision milling machines and lathes and include filing, „polissage“ and „satinage“ by hand.

Every Angular Momentum timepiece
is a unique piece




Bronze Timepiece Bz No. 1
Case, case-back, crown, buckle, movement holder made of Silicon Bronze, polished bezel, satinated sides, hand-winding movement, sapphire crystals on front and back, black natural rubber strap, case caliber 44.00 mm.

The dial „Champlevé“ with Email Lumineuse showing an exotic fish in a reef